73 Amateur Radio Today

DECEMBER 1990
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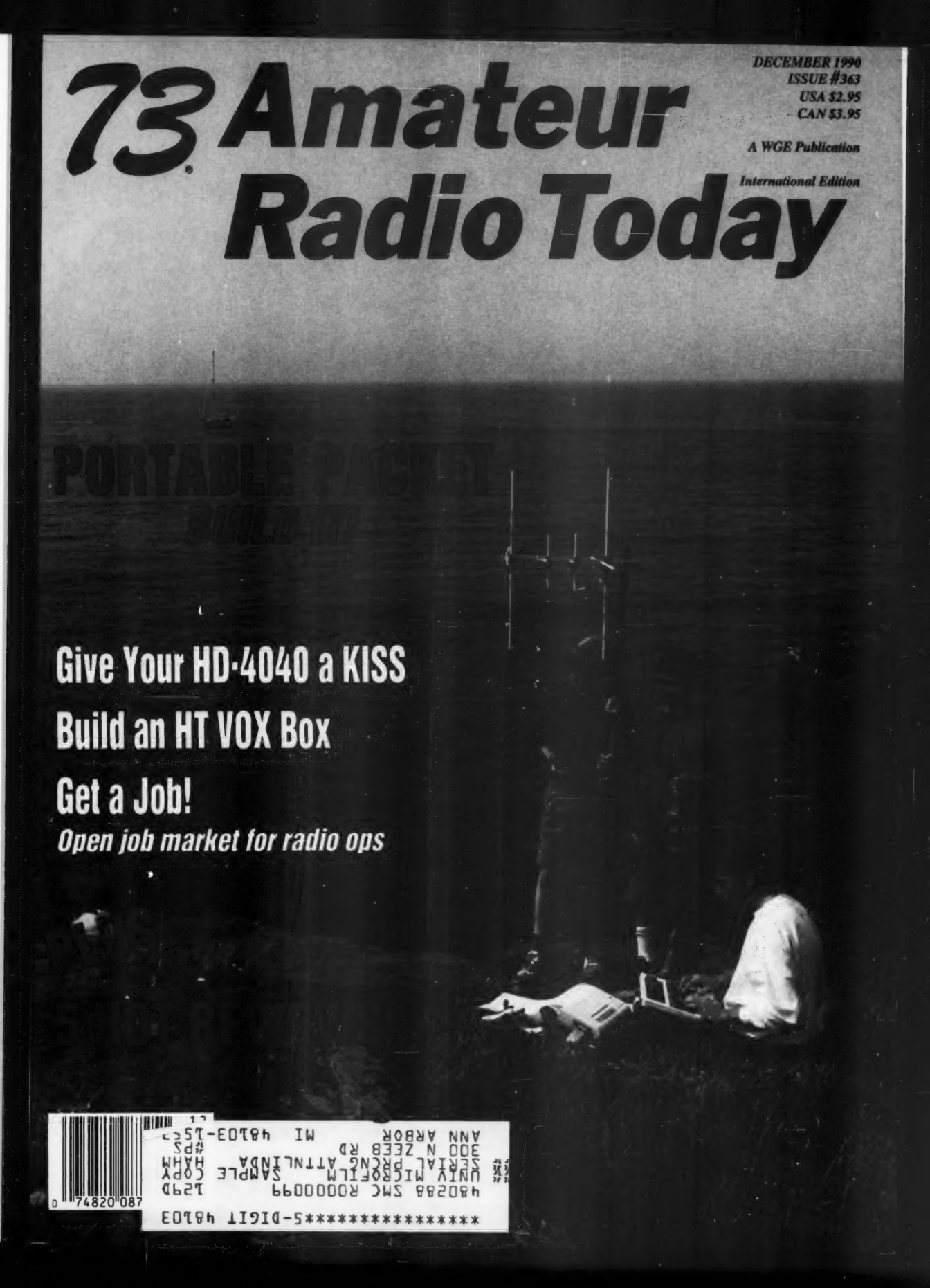

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LETTERS

From the Hamshack

Mike Wengert 9M8XX Have been active on 17m lately. Know what you mean about "contest-type" operation. Hate it! Everytime I get on, nobody wants my opinion. . . just my QSL card! Wham, bam, thank ya ma'am! The Europeans won't gimme a minute's peace. There are still a few people who like to chat, but most are looking for a new country on a new band. Would like to get some middle and high school ham clubs going here, but licensing requires you to be at least 18 years old. Self-defeating, isn't it?

Considering that before the ARRL's Incentive Licensing debacle, 80% of all new American hams were under 18, that's one way to keep Sabah from getting kids interested in high tech careers. . . Wayne

A Maine reader writes: K1MAN has been given a fine of $1,500 for "willful and intentional interference" by the Belfast (ME) FCC office! I like your articles about this BIG MOUTH. He does *nothing* for the area here in Maine; nor do we want him on our repeaters. We have NO USE for him in this area, and I am only some 35 air miles from him. Plus I belong to the Augusta Maine Amateur Radio Club, and we all feel the same about him. Please keep up the "good work." Nail him every chance you get!

Yep, it's a pity, Baxter's IARN is a worthwhile idea, and when not endlessly promoting Baxter, does some worthwhile traffic handling. But this seems mostly because the ARRL has so totally dropped the ball in providing needed emergency services. When St. Lucia was devastated by a hurricane a few years ago, the ARRL did nothing, so I sent a good operator down with a large suitcase of ham gear to help out. And help it did. Doesn't it make sense for the ARRL to initiate and coordinate emergency services instead of leaving it to chance?. . . Wayne

Ozzie KA1BIK Wayne Green, "Never Say Die"—either this guy was just released from the institution or he is absolutely brilliant.

To attract new people to ham radio, you need to sprinkle "radio dust." I remember as a young boy about nine years old peering into the back of a radio and seeing the strange and magical glow from the glass bottles, and when I got my nose close enough, I inhaled "radio dust" and it went directly into my blood stream. Once in the blood stream, it's there for life.

Radio dust is a unique dust baked from the heat of the vacuum tubes and the aroma of melting wax from condensers and warm resistors. It will hook anyone into the weird world of radio. Alas, there is no more radio dust; vacuum tubes have all but disappeared, and so have wax-covered capacitors. Wayne Green's idea for recruiting hams by audio visual methods is probably very good. Wayne, maybe I'll meet you on the air or in the institution.

Bill Wells N4VBK/AA, Atlanta GA As a 37-year-old entrepreneur in the computer business with almost two years as a licensed ham and ink still wet on my advanced ticket, I was appalled when I opened a letter from President Price requesting money to provide "special support" for representation at WARC-92. What kind of idiots do they take us to be? Better yet, what kind of idiots are running the ARRL?

It's time for the League to start spending our money more wisely. I saw the letter as nothing more than a self-ingratiating espousal of what President Price *hasn't* done, i.e., get new hams. The cost of mailing that letter to ARRL members could have purchased (at cost) a lot of copies of *Tune in the World* for schools and clubs, which in turn would produce more hams. We, rank and file members of the ARRL, need your help in purging our directors.

I propose that you give a full page ad to anyone who runs against an incumbent director until the house is finally clean. Sure, it will cost the magazine a lot of money, but as you said, you've never lost enough money to put the magazine out of its misery.

Heck, I'll provide whatever space it takes to help get some new faces in the ARRL annual reports.

Alas, thousands of brain-washed members will get out their checkbooks and send Price money. . . Wayne

Delvin R. Bunton, Vancouver WA Wayne, I like your editorials. They make me think and take stock of my prejudices and cherished opinions. You've finally convinced me to change my priorities and get my license. I anticipate taking my Novice test soon and upgrading to Technician shortly after I get my license.

Even as a nonham subscriber for several years (I think about 10), I recruited the local ham club (Clark County Amateur Radio Club) to set up a booth at several Boy Scout activities (which they did), but it didn't result in any new hams that I know of.

Over the years, I've attended ham club meetings where NO ONE came up to me (an obvious nonmember) and asked my name, interests, or anything else. Small wonder hamdom is dying off when potential new members are not welcomed in a way that encourages return visits.

Stephen Wimmer WU0F, Raymond NB Having been a service tech for nearly 12 years (I quit 3 years ago), I enjoyed Gordon West's "Service Survey Wrap-Up." I heartily agree with *1. Improve your correspondence.* A note that simply says "doesn't work" is a sure sign that the radio *does* work, and that the problem is an accessory. Which brings me to a point I don't understand: *3. No accessories, please.* Too many times I have spent two or three hours on a radio because I believed the customer's note, only to find out later (when I finally got hold of the customer) that the real problem was the mike or some other accessory normally used with the radio. The really bad part about this is that I still have to charge them (my kids need to eat, too).

Next, I want to expand on *4. Better phone numbers.* Remember this country has four time zones. Please give more than one number where you can be reached, and include the times you can be reached at which number, as well. If you use an answering machine, PLEASE play the tape back once a day. Also, it has also been my experience that answering services are even worse.

Steve Weldon N6PZV, 7J6CAR I just received your fourth notice for not renewing my subscription. For the record, I have every intention of renewing my subscription as soon as I relocate in the states in a couple of months.

Most "junk" mail I receive gets thrown out before it's even opened, but a letter with "73" printed on it arouses my curiosity. Why? Because your editorials are interesting, to the point (most of the time), and generally right on the mark. I'm stationed in Okinawa, Japan where entertainment of any kind is greatly appreciated.

There have been many times when fellow hams have sat around their radios on a slow evening and had a lot of fun discussing your editorials. Sometimes when we don't receive our issues of *73* at the same time, entire quotes are transmitted on the local 2m/70m simplex frequencies. Believe me, most hams are extremely happy to have someone with guts representing our hobby.

73 is the best ham radio monthly publication of its kind. There's really little debate on this between the 50 or so American hams stationed in Okinawa. *QST* is plain boring, but very informative on the political side of things, as well as giving current contest information I'm sure somebody uses. *CQ* isn't bad, but for the most part it seems to be put together hastily and without much of a plan. Kind of like someone decided at the last minute to put out a magazine. On second thought, I guess it is bad, sorry for the lapse. At least it isn't as dry to read as *QST*.

73, on the other hand, is a lot of fun to read. The magazine opens up with what we call "Crazy Green's" bitch session. Then you have "QRX," which keeps us abreast of the most current news in amateur radio (*QST* is normally good for the fine details), followed by a variety of interesting articles pertinent to the current generation of hams. Fox hunting, projects, equipment reviews, and "Ask Kaboom" are all interesting to read and informative.

My biggest complaint with *73* is all of the excellent articles on projects I'd like to build and reviews of equipment I'd like to purchase, with absolutely no verification from your staff. Let's face it, most hams who submit articles are "amateurs" (pardon the pun) in the electronics field. We need input like this, but these guys make mistakes, heck even professionals make mistakes, and a double-check method is mandatory for almost anything in this area.

Having a member of your staff assemble and build these projects and report on assembly, function, and relative worth, along with possible improvements, would be a major stepping stone in "professionalizing" these articles.

Next, *QST* provides the best equipment reviews in the business. You can always count on the same set of specs being tested on every radio. Sure, there is some good information in your articles, but they don't carry enough weight for me to make a purchasing decision. For that, I go to *QST*.

Do I expect you to agree with me? Doubtful, as you seem to have already thought out most aspects of your magazine, and I'm sure the reason for my complaint is it just costs too much.

Thanks for your great letter. Readers' opinions and criticisms are important to us, especially when they're as well-stated as yours. Let me address your two main points: construction projects and reviews. Though many of our projects are submitted by "amateurs," the majority of construction articles we publish are written by professionals who have some connection to the electronics field. Your suggestion that a third party also build every project was greeted with enthusiasm by WB8ELK. Unfortunately, we need him to edit the magazine. We simply don't have the staff to re-build every project.

In the area of reviews, I agree that QST does a fine technical review. Why should we repeat their efforts? We want to give a true user's perspective in 73. You could call our review style a "field test" review. By doing this type of review, we feel that we add to the reader's information about a product, and provide a perspective that you can't get anywhere else. Once again, thanks for taking the time to write. . .

David N1GPH

As you say, even professionals make mistakes. Always check the "Updates" department for improvements, new information, and changes. That's what it's for. If you think there's an error in a construction article, get in touch with the author first, just in case. Send us a copy of your letter to the author so we can follow up on it. We check out all reports of possible errors. If you look over "Updates" for the past couple of years, say, you'll find that there are very few errors in our construction articles. . .

Linda KA1UKM/KT

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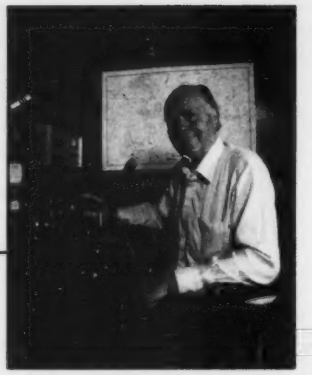
NEVER SAY DIE

Wayne Green W2NSD/1



CQ Owensboro

Some interesting letters have come from Owensboro (KY) with shocking news regarding W4OYI, the ARRL director and his sycophant minions. Before I jump off the deep end I'd like to hear from other local hams and OARC members about what's been going on with the club and the incredible civil defense scandal. Names will of course be kept in confidence.

ARRL Bashing? Me? Forsooth!

A letter from a Novice mentioned something about me bashing the ARRL. . . and the president of his local ham club tearing up a letter from *73* in front of his club members. You can imagine what I think of this jerk.

Despite considerable pressure from some directors to get me to hang ARRL dirty linen out for you, I've tried to keep my editorial comments to ways to improve the League, not how to hurt it. I have little to gain from bashing the League and a lot to gain from improving it. This is my hobby too, you know.

The next time someone gripes about me bashing the ARRL you'll find that (1) I've been an active member far, far longer than he (or she) has (I have my 50-year pin, how's he doing?). (2) I've kept very close track of the League for the last 40 years and known most of the directors, the officers and the HQ people personally. (3) I've been more active in amateur radio than anyone else in the world, I believe. I say that from the viewpoint of the hamming I've done. . . such as DXing from over 50 countries, working via OSCAR, working 350 countries, pioneering RTTY, repeaters, NBFM, SSTV, and SSB; won Sweepstakes, VHF, DX and other contests; built my own gear for many years; worked moonbounce, seven states on 10 GHz from NH, been publishing ham mags for 39 years, FCC's NIAC member for years, founding member FCC's LRPC, represented US at ITU in Geneva, have addressed ham clubs and conventions all over the world, etc. So why is it out of place for me to make suggestions for ways the ARRL can be improved? Who better in the hobby knows?

I hear the inside dirt from disgusted ARRL directors. I've heard the FCC's side of everything for the last 40 years too, having talked with many of the Commissioners personally. I've regularly heard from disenchanted HQ staffers.

Do you suppose that the people in the industry know what's really going on? You better bet they do. And how many of them have you talked with confidentially? I know most of 'em personally and you'll get your eyes opened if you talk with some of them.

Now tell me this, what do you imagine I have to gain from bashing the ARRL? I've heard that this is supposed to sell magazines and that Wayne is out after the buck. I have never heard that from anyone with an IQ in three digits or who actually knows me . . . and I don't expect to. Bashing the ARRL does not sell magazines, it just makes blindly loyal members so angry they could spit. Non-members mostly could care less. There aren't many ARRL-haters. . . just mostly lovers who believe the ARRL can do no wrong . . . and then there are about two-thirds of the hams who really don't give a damn and really don't want to be bothered. Most don't read any ham magazines at all.

About Money

People who are hung up on money are to be pitied. I sure don't envy people who spend like Donald Trump. I probably spend less money on myself than most of you, yet I see ways to make money everywhere I turn. There are incredible opportunities, once you tune your mind to that wavelength. I could start at least one new, profitable business every day.

I'm an entrepreneur. Always have been. When I was 12 I started a mail order stamp business. If you read more than comic books and *QST* you know that entrepreneurs go into business for the fun of it and few, if any, are money-oriented. Oh, we know we have to make money or we go out of business, so we tend to make money. But the money is never the goal.

73 has lost a little money most, if not all, of the 30 years since I started it. Sure, I could set the ad rates higher and make a profit. . . or charge more for subscriptions. . . but as long as it doesn't lose a lot, big deal. I publish it because I enjoy it.

When I published computer magazines I put everything I made right back into starting more magazines and services. I published dozens of books, hundreds of programs, and seven computer magazines. Whenever it looked as if we might get some money ahead I'd start a new publication or service.

Now I'm doing the same thing again. I recently listed some of the new companies I've formed and am forming. There are even more now, with only our difficulty in finding people slowing us down.

I've enjoyed hamming for over 50 years and I'd like to be able to continue for what few years I've probably got left. But this means trying to get you to get the ARRL to do what needs to be done. Now tell me, do you honestly think my detractors know better what needs to be done than I do? Have they done their homework? I have.

And tell me again about how they say I'm just trying to get more *73* subscribers because of greed. . . and I'll think they are nitwits. My apologies to the other nitwits.

I suppose, if the current ARRL directors have their way and you don't replace them in the next election, I can always get started with some landline bulletin boards and Compuserve and get more involved with my Mac as a substitute. It won't be the same as working DX on 20m, but it'll be fun reminiscing about our hobby after it's gone.

Things can move fast these days. Look how quickly East Germany disappeared. And how fast the communist Eastern countries changed! The 1992 ITU conference will soon be upon us. There we will face pressures from every country in the world to give up our bands. Will we even have the support of our own government? How much would you like to bet?

Friends tell me my problem is that I'm too much involved with amateur radio. . . that I care too much. After all, it's only a hobby! Maybe they're right and I should spend more time on other things. . . like music and education.

Hold on, someone's calling me on the repeater. . . gotta go.

If You Were President. . .

Of the ARRL, not America. . . let's not bite off too much at once. Bush has his hands full with Iraq, the budget, the balance of payments, the S&L mess, the bank bomb (Third World loans), our education debacle and so on.

And we in amateur radio have a discouraging situation facing us. Here we are with large chunks of our spectrum allocations under siege from every quarter. What few of us are left are more involved with fighting each other than the enemy. If you are going to be anything more than a caretaker League president, arranging the deck chairs on the Titanic as we sink, you have an awesome responsibility. What would you do?

Spectrum needs are avalanching upon us. The Information Age means communications. We're talking tens of millions of personal telephones in shirt pockets, and that's just for starters. The next generation will be pocket personal communications centers that will allow us to talk, handle voice-forwarded messages, FAX, and even data and graphics. We're talking major spectrum needs, even with spread spectrum communications and data-compacting algorithms.

Our delivery giants such as UPS and Federal Express will want to be able to trace any package right down to the truck it's on. . . instantly. High definition television, digital sound, world computer networking, and hypermedia access all mean more spectrum needs.

What priority would you give a bunch of testy old codgers, mostly retired, almost none black or any other minority, not even many women. . . if you were going to be fair in allocating spectrum for them to while away their few remaining years instead of watching TV or playing golf?

You might want to listen and see what they're doing with the billions of dollars in frequencies they're using. Let's see now, their most important band, by far, is 20 meters. . . how's that doing? This is the band that a hundred Third World countries would give almost anything to use to broadcast to their expatriates and keep them in touch with their homeland.

You start at the low end of the American phone band and you hear the pileups. . . each with hundreds of crazed old men calling and cursing each other, trying frantically to get through to a rare one. You hear the California "kilowatts". . . which sound more like 50,000 watts, all calling endlessly so that no one can even hear the weak DX station. You hear catcalls. You hear frustration and anger, not people having fun.

The beleaguered DX operator has little control of the mess he has generated and no matter how he pleads for cooperation and a chance to actually talk with someone, the hordes are merciless. This is blood. This contact must be made. Just give me a signal report, never mind your damned name, you jerk. And break, break, who's your QSL manager again?

With a sigh you tune up the band. The next 50 kHz is full of chirping carriers. Slow-scan. Hmmm, pinup pictures from *Penthouse* and *Gallery*. And one chap with a computer typing at about three words per minute onto his slow-scan raster.

Continued on p. 73

KENWOOD

TS-950SD

"DX-clusive" HF Transceiver

The new TS-950SD is the first Amateur Radio transceiver to utilize Digital Signal Processing (DSP), a high voltage final amplifier, dual fluorescent tube digital display and digital meter with a peak-hold function.

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• **New! Digital AF filter.** Synchronized with SSB IF slope tuning, the digital AF filter provides sharp characteristics for optimum filter response.

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• **New! Built-in microprocessor controlled automatic antenna tuner.**

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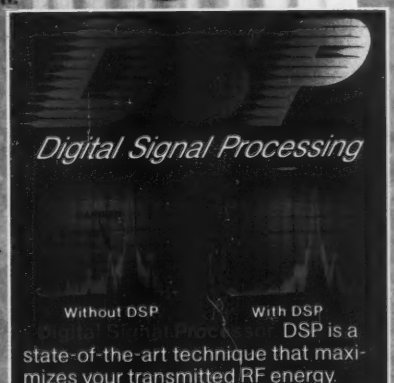
Complete service manuals are available for all Kenwood transceivers and most accessories.
Specifications, features and prices subject to change without notice or obligation.

The Ultimate Signal.



DSP is a state-of-the-art technique that maximizes your transmitted RF energy.

• **High performance IF filters built-in†** Select various filter combinations from the front panel. For CW, 250 and 500 Hz, 2.4 kHz for SSB, and 6 kHz for AM. Filter selections can be stored in memory!

• ***Multi-Drive Band Pass Filter* (BPF) circuitry.** Fifteen band pass filters are available in the front end to enhance performance.

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Optional Accessories
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• SO-2 TCXO* • VS-2 Voice synthesizer
• YK-88C-1 500 Hz CW filter for 8.83 MHz IF*
• YG-455C-1 500 Hz CW filter for 455 kHz IF*
• YK-88CN-1 270 Hz CW filter for 8.83 MHz IF
• YG-455CN-1 250 Hz CW filter for 455 kHz IF*
• YK-88SN-1 1.8 kHz SSB filter for 8.83 MHz IF
• YG-455S-1 2.4 kHz SSB filter for 455 kHz IF*
• SP-950 External speaker w/AF filter
• SM-230 Station monitor w/pan display
• SW-2100 SWR/power meter
• TL-922A Linear amplifier (not for QSK)

* Built-in for the TS-950SD
† Optional for the TS-950S

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- **50 watts on 2 m, 35 watts on 70 cm, 25 watts on 1-1/4 m.** Approx. 5 watts low power.
- **Automatic offset selection.**
- **Dual antenna ports.**
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- **16 key DTMF/control mic. included.**
- **Frequency (dial) lock.**

Optional Accessories: **PG-4H** Extra interface cable for IF-20 (for three to four radios) • **PG-4J** Extension cable kit for IF-20 DC and audio • **PS-430** Power supply • **TSU-6** CTCSS decode unit • **SWT-1** 2 m antenna tuner • **SWT-2** 70 cm antenna tuner • **SP-41** Compact mobile speaker • **SP-50B** Deluxe mobile speaker • **PG-2N** DC cable • **PG-3B** DC line noise filter • **MC-60A, MC-80, MC-85** Base station mics. • **MA-700** Dual band 2 m/70 cm mobile antenna (mount not supplied) • **MB-11** Mobile bracket • **MC-43S** UP/DWN hand mic. • **MC-48B** 16-key DTMF hand mic.

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"Dynamic Duals"

Complete service manuals are available for all Kenwood transceivers and most accessories.
Specifications, features and prices are subject to change without notice or obligation.

QRX . . .

EDITED BY LINDA RENEAU KA1UKM

Radio Officers Needed

Radio officers are urgently needed! If you have a valid FCC radiotelegraph license with a 6-months endorsement (or one that has not lapsed more than five years), a U.S. Coast Guard license, and good health; and if you can accept an immediate sea assignment, contact Mr. Bernie Stoller of the ARA (a radio officers union) at (201) 795–5536. You can also obtain additional information from Mr. Chris Krusa, U.S. Maritime Administration, at (202) 366–5755 for referral to a shipping company. Assignment will be to a ship from the ready-reserve fleet. So far, due to the Persian Gulf crisis, 40 ships have been activated and more will be in the near future. TNX *W5YI Report*, Vol. 12, Issue #19. Also, see the article "Pack Your Seabag, 'Sparks,' " in this issue of *73*.

FCC Investigations

The FCC's Field Operation Bureau is investigating reports of interference with the TIKI distress call on the maritime net frequency 14.313 MHz on the morning of May 19. Any amateur radio stations with tapes of the incident are requested to mail them to Mr. John R. Hudack, FCC Room 744, 1919 "M" St., Washington DC 20554.

On another matter, the FCC has asked Glenn Baxter K1MAN to justify his practice of running taped "news" and bulletin transmissions without regard for QSOs in progress at the time the bulletins begin. The FCC also cited K1MAN for improper identification and running illegal phone patches.

Concurrently, it seems, K1MAN sent the FCC a notarized affidavit charging KV4FZ, who was in contact with WD4GDP, with refusing to relinquish 14.275 for emergency logistical Red Cross medical traffic with a station in Iran. The affidavit states there was malicious and intentional interference later the same day. K1MAN was quoted as saying that if the FCC doesn't take some of his recommended actions against KV4FZ, WD4PZT, and NR6X for repeated interference, he plans to take the FCC to the Circuit Court of Appeals in Washington DC. Since Baxter K1MAN, as the proponent of AM modulation, took the FCC through the courts to the Supreme Court, this may be no idle threat. TNX *B-N-T*, Vol. 18, Issue 9, and the *Balanced Modulator*, Vol. XXV, No. 9.

Do Not QSO Kuwait

A QSO with a Kuwaiti amateur could cost him his freedom or his life. According to a message issued last September by the Radio Society of Great Britain via its GB2RS broadcasts, under no circumstances should you hold a QSO with any station operating from Kuwait. This is for the Kuwaiti amateur's safety. The RSGB says that the Kuwaiti Embassy in London requested them to issue this bulletin to amateur operators worldwide. It is not known if the Kuwaiti ambassador to the U.S. made a similar request to the FCC or ARRL. TNX *Westlink Report*, Sep. 28, 1990.

Questionable Questions

Two questions in the outstanding pools may cause problems in future testing. The first is: *2H-1-4.1 What emission designator describes single-sideband suppressed-carrier (SSB) voice transmissions?* When this question was originally written, the answer was J3E, of course. But now that Part 97 has been rewritten, the answer according to the present wording of the rules is "sideband phone." Thus, the question now gives away the answer!

The second question is: *4AC-4.2 How much farther does the radio-path horizon distance exceed the geometric horizon?* This question was originally released in the fall of 1986 with this answer as correct: "By approximately 1/3 the distance." The distractors (wrong answers) included "twice, 1/2, and four times the distance," respectively. Having reservations about the answer, the ARRL asked their propagation technical advisor (not on the League staff) to look into the matter. He eventually determined that none of the answers were accurate. The Technical Advisory Committee for the Question Pool Committee advises that there is not a solid answer to the question in the first place. The committee believes at this point that the most practical way to handle both of these questions is to formally remove them from the question pool. TNX Western Carolina Amateur Radio Society/VEC Inc.

Solar Cycle 22

Recent activity suggests there's still some life left in Cycle 22. During the week of August 27, the solar flux index soared to a level of 317. The is close to the highest solar flux reading of 335, which occurred during the second week of July in 1989. The latest rise stayed above 300 for six days, and was accompanied by several massive solar flares.

Normally, a solar cycle lasts about 11 years. If the peak did occur last summer, as some suspect, that would put Cycle 22 on a 6-year schedule. But then again, since this is only the 22nd solar cycle ever documented, maybe we don't yet know what the "norm" is.

Propagation expert Jim Gray W1XU reminds us that sunspots have been observed and recorded for only 250 years, and the sun is several billion years old. Since even our best records reveal only the briefest instant in the sun's life, it's likely that we have a great many surprises in store for us regarding the sun's behavior. TNX *The Ground Wire*, Vol. IV, No. IX, and *73* "Propagation" columnist, Jim Gray W1XU.

Digital Audio

Canada has been testing DAB—wide-spectrum digital audio broadcasting. First reports indicate quality far surpassing FM stereo. Expert observers in a specially equipped minibus reported superb audio with no multipath distortion, even when traveling in downtown "canyons" and over steel bridges. Some of the passengers even suspected trickery, believing that there was a hidden CD player aboard the minibus.

The transmitter for the first round of tests was a 1 kW unit modified to operate on UHF TV channels 68 and 69. Many observers expect DAB to eventually replace both AM and FM broadcast stations in Canada, and perhaps the world. Canadian broadcasters are looking for American support at the 1992 WARC Conference for a proposed digital radio band. The desired spectrum would be somewhere between 100 MHz and 1.5 GHz.

It seems like everyone in the world is out to get more megahertz at WARC '92. Particularly worrisome to the ham community are technologies like DAB and High Definition TV, which require very big blocks of the spectrum. TNX *The LCARA Patch, AARCOVER*, and Miles Abernathy N5KOB for this information from *Radio World*, a magazine for commercial broadcasters.

Didah Publishing

Do you ever have trouble locating past articles in the ham magazines? Some of the *73* staff ran into Didah Publishing at the Deerfield, New Hampshire, hamfest. In *From Beverages thru OSCAR—A Bibliography*, Didah has indexed every article ever published in *QST, CQ, Ham Radio*, and *73 Magazine*. It also includes 10 years of *RadCom*. Updates are available every December. The entire data base is available on disk or microfiche. They also provide printed lists, one indexing over 3400 product reviews. You can contact Didah Publishing at P.O. Box 7368, Nashua NH 03060-7368. Tel. (603) 878–3628/883–5152.

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This MFJ Keyer is small in size but big in features. you get iambic keying, adjustable weight and tone and front panel volume and speed controls (8-50 WPM), dot-dash memories, speaker, sidetone and push button selection of automatic or semi-automatic/ tune modes. It's also totally RF proof and has ultra-reliable solid state outputs that key both tube and solid state rigs. Use 9 volt battery or 110 VAC with MFJ-1305, $12.95.

The keyer mounts on a Bencher paddle to form a small (4-1/8 x 2-5/8 x 5½ inches) attractive combination that is a pleasure to look at and use.

The Bencher paddle has adjustable gold plated silver contacts, lucite paddles, chrome plated brass and a heavy steel base with non-skid feet.

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MFJ-949D is the world's most popular 300 watt PEP tuner. It covers 1.8-30 MHz, gives you a new peak and average reading Cross-Needle SWR/Wattmeter, built-in dummy load, 6 position antenna switch and 4:1 balun – in a compact 10 x 3 x 7 inch cabinet. Meter lamp uses 12 VDC or 110 VAC with MFJ-1312, $12.95.

Antenna Bridge

MFJ-204B **$79.95**

Now you can quickly optimize your antenna for peak performance with this portable, totally self-contained antenna bridge.

No other equipment needed -- take it to your antenna site. Determine if your antenna is too long or too short, measure its resonate frequency and antenna resistance to 500 ohms. It's the easiest, most convenient way to determine antenna performance. Built in resistance bridge, null meter, tunable oscillator-driven (1.8-30 MHz). Use 9 V battery or 110 VAC with AC adapter, $12.95.

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"World Radio TV Handbook" says MFJ-1024 is a "first rate easy-to-operate active antenna ... quiet ... excellent dynamic range ... good gain ... very low noise ... broad frequency coverage ... excellent choice."

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Receives strong, clear signals from all over the world. 20 dB attenuator, gain control, ON LED. Swtich two receivers and aux. or active antenna.6x3x5 in. Remote unit has 54 inch whip, 50 ft. coax and connector. 3x2x4 in. Use 12 VDC or 110 VAC with MFJ-1312, $12.95.

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VHF SWR/Wattmeter

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Covers 2 Meters and 220 MHz. 30 or 300 Watt scales. Also reads relative field strength 1-170 MHz and SWR above 14 MHz. 4½x2¼x3 in.

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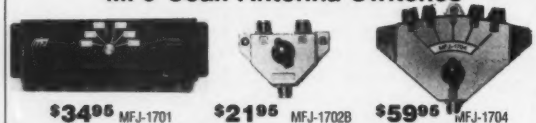

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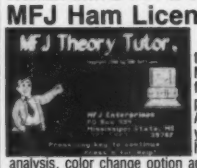
MFJ Ham License Upgrade Theory Tutor



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CIRCLE 86 ON READER SERVICE CARD

Behold the BackPacket!

Go take a hike with packet radio.

by Jon Trent Adams NW6H

I'm an explorer, so I enjoy amateur radio partly because of the security and companionship it affords me when I journey out alone into the badlands of the Southwest. Whether I'm away from home for just a night, for a weekend, or for a week or two at a time, I always try to carry along some piece of equipment that will let me (or at least let me attempt to) communicate with local hams, or even with my friends back home.

Carrying a little HF rig around is possible, but stuffing a TH7DX and power supply into a suitcase is a bit difficult. The AC cord is always a bear. In the Southwest, at least, I can carry a VHF or UHF handheld radio that usually lets me communicate locally—and sometimes all the way back to Los Angeles.

Sometimes It Gets Lonely Out There

Not that I usually have very much to say—I'd just like to know if the house is still standing, perhaps try to set up a schedule on 40 meters with friends back home, or maybe yak, just for the novelty of it, from some remote, isolated slab of sandstone near Moab, Utah, or from atop a big block of ancient ocean reef in West Texas. Of course, underlying all these whimsical desires is the *true purpose*: To be able to provide reliable communications at a moment's notice from any weird location I find myself in.

What's the best way of doing this? I could carry a QRP 40 meter CW rig. I could set up a station in a hurry with a small 10 watt radio, a battery and a long piece of wire. Then, assuming that an operator can be found out there in the QRM and N to hear my weak station, we might be able to communicate. But I might not be able to work locally. I might not be able to battle the big guns successfully. I would have to be at the equipment

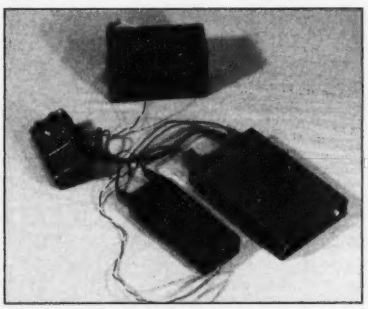


Photo A. The individual components of the BackPacket.

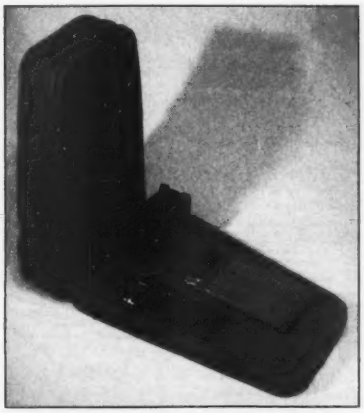


Photo B. Carving the foam for a snug fit.

when the messages came in and, of course, operate the equipment when a message needed to be sent repeatedly to get through the chaff. (I'd also have to bone up quite a bit on my decidedly poor CW fist and ear.) Not a good solution for my predicament.

Enter Packet Radio

Packet provides a mode of communications that is relatively automatic and error-free. Given that there are now packet radio digipeaters in most parts of the Southwest (even in the wilds of Springerville, Arizona, and Pecos, Texas) there exists (in theory) a possible method for me to get information back and forth between almost any two far-flung points. Since I picked up my first TNC, little more than a year ago, I have seen the activity on packet grow and expand into a somewhat viable network.

I needed a prototype mobile terminal to get into the system and test the concept. My first attempt was with an MFJ-1270 TNC. I bought a little Epson PX-8 laptop computer, complete with built-in telephone modem, tape drive, serial ports and RAM disk. In my truck I installed the TNC, a Yaesu FT-209 handheld 2 meter radio with mobile charger, and a quarter-wave mag-mount antenna stuck on the fender and dedicated to that radio. With a custom-made cable harness and dash-mounted interface box, I had a mobile packet station that allowed me to use either the handheld, low-power radio or the 25 watt mobile radio for the packet station.

There it was! My first mobile packet station (don't type while you drive)! A moderate success, limited only by the 5 watt output of the FT-209 and the horrible amount of 2 meter interference generated by the TNC. But I was able, in my short two week vacation through the Southwest, to keep in touch with the local packeteers and, occasionally, the hams back home. In fact, I generated quite a few of the local contacts (out there, local is within two hundred miles) simply by transmitting a beacon through the nearest digipeater with beacon texts like: "Hola from NW6H mobile on US 60 near Datil, New Mexico." It was like shooting fish in a barrel—I lured them in with those names of exciting, exotic places.

My friend Greg Noneman WB6ZSU was on vacation, driving from Los Angeles to Denver and back. He installed a similar station in his truck. With it (relying occasionally on 40 meters—at that time the packet digipeaters in New Mexico were few and far

Continued on page 12

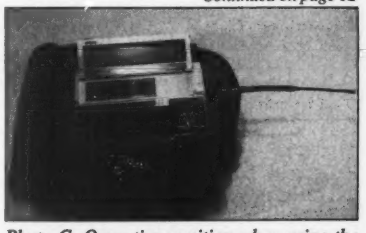


Photo C. Operating position when using the laptop computer.

Photo D. The BackPacket ready for the hike.

AEA ...Brings You A

Keyers

The Morse Machine MM-3 Keyer

The Morse Machine has all the features you need in a memory keyer, including 2 to 99 WPM speed selection and over 8,000 characters of soft-partitioned memory. Twenty memories store your messages...as short or as long as you like. Memory can be expanded to 36,000 characters. All memory is backed up by an internal lithium battery.

Comprehensive Morse training facilities are built-in. **A Proficiency Trainer** for random code group practice. **A Random Word Generator** which generates four-letter words and **A QSO Simulator** which allows you to call stations, answer a CQ or listen to realistic on-the-air QSO's.

The MM-3 also features automatic serial number insertion and incrementing in any memory message. Use the front panel knob to adjust your sending speed or enter a precise speed with the keypad, toggling between the two at any time. Exchanges can be expedited by having parts of your message sent at a higher speed. You can even add remote switches for four of the memories to send your response or call CQ. The MM-3 can also be programmed for automatic beacon use. The RS-232 compatible serial I/O port provides computer control of the MM-3 and monitoring of the Morse training features.

Packet

PK-88 Packet Radio TNC

Unique operating features with a proven hardware and software design make AEA's PK-88 your best choice in packet radio--now with MailDrop, an 8KByte efficient personal Mailbox. The PK-88 also allows multiple single frequency QSO's, digipeating and networking. It's a superb value, packed with all the most needed packet radio features such as direct interface capability with NET/ROM and TCP/IP. In addition to all the features of a "standard" TNC, the PK-88 offers features not found in any other TNC:

- WHYNOT command - Shows reasons why some received packets are not displayed.
- "Packet Dump Suppression" - Prevents dumping unsent packets on the radio channel when the link fails.
- CUSTOM Command - Allows limited PK-88 customization for non-standard applications.
- Enhanced MBX command- Permits display of the data in I- and UI-frames, without packet headers and without packet headers or retried frames.
- Enhanced MPROTO command - Suppresses display of non- ASCII packets from Level Three switches and network nodes.

Multi-Mode

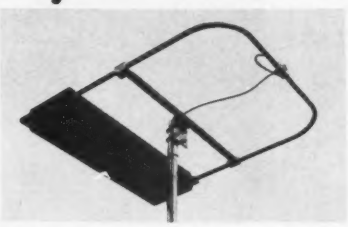
PK-232MBX Multi-Mode Data Controller

With over 40,000 units sold worldwide, the PK-232MBX is the world's leading multi-mode data controller. Combining all amateur data communication modes in one comprehensive unit, the PK-232MBX offers Morse Code, Baudot, ASCII, AMTOR/SITOR 476 and 625, HF and VHF Packet, WEFAX receive and transmit, TDM, as well as commercial standard NAVTEX automated marine information services.

All software is on ROM.

- 20 front panel status and mode LED indicators
- RS-232 compatible
- Exclusive SIAM™ Signal Identification and Acquisition Mode
- TDM Time Division Multiplex decoding
- PakMail™ mailbox with selective control of third-party traffic
- FAX printing - supports most printers
- Two radio ports
- Host mode for efficient program control of the PK-232MBX
- KISS mode for TCP/IP networking protocol compatibility
- 32K RAM lithium battery-backed
- Many features for the digital SWL

Antennas



IsoLoop™ 14-30 MHz Compact HF Antenna

AEA brings you the breakthrough in compact HF antenna design with its high-performance, low-profile IsoLoop HF antenna. Designed specifically for hams with limited space or antenna restrictions, the 32"-square IsoLoop covers all frequencies from 14 to 30 MHz, at up to 150 watts continuous.

No ground radials are needed and its balanced, shielded feed-loop isolates the antenna from the feedline. This ensures that your signal is radiated by the antenna, not the feedline, which helps eliminate TVI and stray RF in the shack.

The inherent hi-Q of the IsoLoop makes it like a very sharp tunable filter that radiates. The narrow bandwidth suppresses harmonics from your transmitter, and also attenuates out-of-band signals that could overload your receiver.

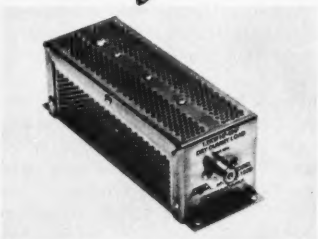
The omni-directional IsoLoop makes an excellent attic or balcony antenna, and because it weighs only 12 pounds is also perfect for portable use.

Advanced Electronic Applications, Inc. 2006-196th St. SW/P.O. Box 2160 Lynnwood, WA 98036 206-775-7373

CIRCLE 65 ON READER SERVICE CARD

Better Experience

Dummy Load

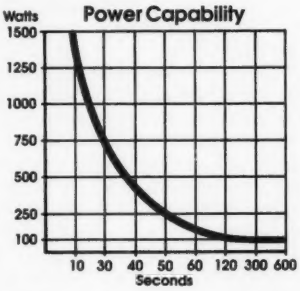


DL-1500

DC-650 MHz Up to 1500 Watts

AEA's dry dummy load simulates a perfect 50 ohm antenna up to 650 MHz so you can test your transmitter without radiating a signal on the air.

- DC-650 MHz
- Simulates matched 50 ohm transmission line to test your transmitter
- Handles short-term RF power up to 1500 watts
- VSWR of less than 1.3:1 at 650 MHz
- Compact and lightweight
- Air cooled dry load



Econo Tuner

ET-1 Antenna Tuner

300 Watts of All-Band Tuning

Meet your match with AEA's new ET-1 Econo-Tuner™. A quality, economical antenna tuner for under $150, the ET-1 Econo-Tuner is designed to match virtually any receiver, transmitter or transceiver from 1.8 to 30 MHz with up to 300 watts of RF power.

Compatible with almost ANY antenna including verticals, dipoles, inverted vees, beams and mobile whips that are fed by coax cable, balanced lines or a single wire. For easy connection to balanced lines, a 4:1 balun is built-in.

A front panel switch control allows you to switch between two coax-fed antennas (direct or through the tuner). You can also switch to a balanced line or wire antenna. The BYPASS position allows you to switch to a dummy load (such as AEA's DL-1500 dry dummy load) or a direct connected coax antenna. In the BYPASS position, COAX 1 OUT or COAX 2 OUT can be selected so that the tuner is bypassed, but not the meter circuit.

The ET-1 features a precision dual-movement meter to simultaneously monitor power and SWR.

Unique engineering designs have made AEA one of the leading innovators in the amateur radio industry. That same quality and superior technical support make the ET-1 your best deal for an antenna tuner.

Antennas

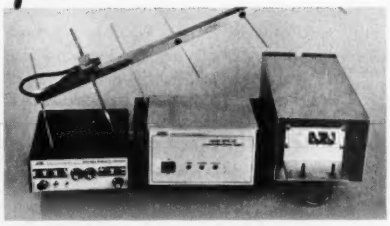
IsoPole™ Omni-Directional VHF and UHF Base Station Antennas

An outstanding mechanical and electrical design make the IsoPole the best choice for an economical omni-directional VHF or UHF base station antenna. All IsoPole antennas yield the maximum gain attainable for their respective lengths and a zero degree angle of radiation which puts the most signal on the horizon. Exceptional decoupling results in simple tuning and a significant reduction in TVI potential. Decoupling cones offer great efficiency over obsolete radials which radiate in the horizontal plane. The IsoPoles also have a broader frequency coverage than any comparable antennas. Typical SWR is 1.4 to 1 or better across the entire band!

All mounting hardware is stainless steel. The decoupling cones and radiating elements are made of corrosion-resistant aluminum alloys. Aerodynamic cones are the only appreciable wind load and are attached directly to the support (a standard TV mast, not supplied).

IsoPoles are ideal for packet radio. The decoupling cones stop computer hash picked up by the outer shield of the coaxial cable from being passed to the receiver.

Amateur TV



AEA's New ATV System

Add a new dimension to your amateur radio communications with AEA's Amateur Television (ATV) system. If you hold at least a technician-class license, you can transmit and receive live or taped audio and video Fast-Scan TV (FSTV) information that rivals broadcast quality. Now you can share more than conversation over the air with this new mode of "personal communications."

It's Easy and Inexpensive. If you have a video camera or camcorder and a standard TV set, you may already own the most expensive components of an ATV system. AEA's ATV system includes a transceiver and antenna. Simply connect the camera, TV and the antenna to the transceiver, and you're on the air LIVE with one watt P.E.P.! If you want to broadcast with more power, AEA also offers a 50 watt mast-mounted linear amplifier and GaAsFET preamp with power supply. Your TV set will monitor your transmitted and received pictures.

Amplifier Now Available.

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CIRCLE 65 ON READER SERVICE CARD

Continued from page 9

between) he and I were able to leave messages with one another. We even scheduled a rendezvous in Roswell, New Mexico, at the local Dairy Queen!

This success spurred me onward. I was ready for the big time. By now, most of our little group of packeteers were packet-mobile, some always, others on an hour's notice. We decided to stretch our muscles.

The First Public Experiment

Our dedicated group of bit-bangers were invited by the organizers of the "Angeles Crest 100 Mile Endurance Run" to put together a packet radio demonstration by providing an alternate, redundant, and completely experimental route for important status and welfare communications for the nearly sixty runners in the race. This ultra-marathon foot race was held in September 1987 in the San Gabriel mountains above Los Angeles. The packet stations, spread out over the course of the race, were set up to pass runner times and location information to our main database computer at race headquarters, where Search and Rescue personnel would be able to monitor the runners' progress.

I found that generally the information collected via our network was available at race headquarters more quickly via our fledgling packet network, set up that weekend, than when it was sent on the established voice network that we paralleled. Our system did not work perfectly, but at least it proved that the ability was there.

I called it another success. After the race, our group realized that what was really needed was a dedicated digipeater or two placed in ideal spots on isolated mountain peaks where there was no access except by foot. Perhaps we could also add a few terminals a couple of miles from any power or vehicular access. These devices would need to be robust, easily transportable, and fully self-contained. It wouldn't be easy to lug a bunch of radio equipment up a four-mile trail in a briefcase. It had to be packaged correctly.

Enter the BackPacket!

The BackPacket consists of a PacComm Micropower-2 TNC, an Epson PX-8 laptop, a Yaesu FT-203 handheld, a 7 amp-hour sealed lead-acid battery, all encased in a very sturdy Ensolite laminate in a JanSport day pack. The external pockets of the BackPacket hold antennas, connectors, chargers, extra cable, maps and other necessities. This is important because it lets you grab the bag in a hurry without having to remember all the little parts that usually get left behind.

When operating just as a digipeater it has a lifetime of nearly four days; when used as a terminal it has sufficient battery life for anywhere from one to three days, depending on the duty cycle of the terminal.

What is the most critical problem when attempting to assemble something like this? Number one on the list is RFI—radio frequency interference! Let's face it—the digital world and the analog world (TNCs, laptop computers and radio transceivers) are quite incompatible. The common cure for RFI complaints involves bypassing and shielding. When that doesn't work, the next step is to put separations between the interacting equipment.

The first two methods can help some, but the shielding can add extra weight, something I don't need here. Separation is an impossibility because of the already-defined space of the day pack. The only other possibility is orientation: sometimes a few extra dBs can be squeaked out there.

Constructing the BackPacket

The BackPacket's components are encased in a laminated sandwich of Ensolite, the material used for sleeping bag pads. This material is a ½ inch thick closed cell, dense, flexible foam that is available from most camping supply stores and is used to pad hips and shoulders when used as a sleeping pad. It also provides excellent protection for the laptop, TNC, radio and battery.

My first step was to find a proper pack. I spent several weeks lurking around the various backpacking shops in Los Angeles, attempting to find a sturdy, durable bag that not only had enough physical volume to hold the parts but also had external pockets, gussets and other widgetry so that all vital accessories could be carried as part of the package.

Unfortunately, almost all of the bags I looked at weren't designed for my purpose. (Don't these guys ever think of carrying a laptop computer and a 15-pound battery around?) I considered briefly, then discarded, the idea of building my own custom bag. I also looked at the plethora of camera bags. Most of these were not deep enough to hold the computer, and all were frightfully expensive. (I figure that the camera bag manufacturers know that you've gotta be rich to buy these fancy modern cameras.) Also, a back-borne bag would be easiest to carry and would leave my hands free; a camera bag flops around too much. I realized that most bags would require extensive modification to suit my needs.

I finally found a reasonable bag made by JanSport: the Super Sack. This bag had just enough internal volume to hold all the required equipment and not much more. At the least-protected points there would be no less than a half-inch of foam between any component and the outside. The bag is made of Cordura, a very tough, heavy nylon weave. Leather gussets and bosses are sewn on the bag at various places as attachment points and there are two long vertical pockets aside the main pack body. The entire base of the bag is made from a single piece of heavy, top-grain cowhide. It looked like a very durable bag. So, it came home with me.

I needed a template showing the internal shape of the bag. The pack body itself is somewhat tear-shaped. I made a rough measurement of the interior, cut a piece of heavy cardboard slightly oversized, then, through successive fittings, pared the cardboard down to size.

Using the template, I cut 12 pieces of Ensolite in this shape. At one half-inch per piece, 12 pieces stack up to provide a six-inch block of Ensolite sandwich. This stack of foam fits quite well into the bag volume, with little gap.

Next came the hard part: laying out the individual components, routing the cabling, and cutting out spaces in the Ensolite. I began with a single piece of foam as the base layer. This provided a minimum half-inch of foam between my back and any component in the BackPacket. On this layer I organized the TNC, battery and radio. I drew the outlines of the components on the surface of the succeeding foam layers, and proceeded to cut out two pieces of foam with those exact cutouts. (A new X-Acto blade will last about two minutes in this service; be prepared to change the blades regularly.) These fit snugly on the bottom piece, with the individual layers of foam cemented to one another using standard contact cement. Layers six through twelve were cut to house the battery, computer and control panel. I used this same construction technique to build up the full six-inch height of the foam block. The block breaks open between layer three and layer four to provide access to the radio and TNC.

Once the components were in place, I built shielded cables and carved channels in the foam to accommodate these interconnects. I used shielded cables and metallized cable hoods wherever possible to keep the installation electrically clean.

The TNC, radio and battery base are located at the bottom of the foam stack. On top of the TNC and radio, separated by another half-inch of foam, rests the Epson laptop. The final foam layers surround the laptop and the rest of the battery. Two cutouts of foam protect the top of the laptop when the BackPacket is in transit.

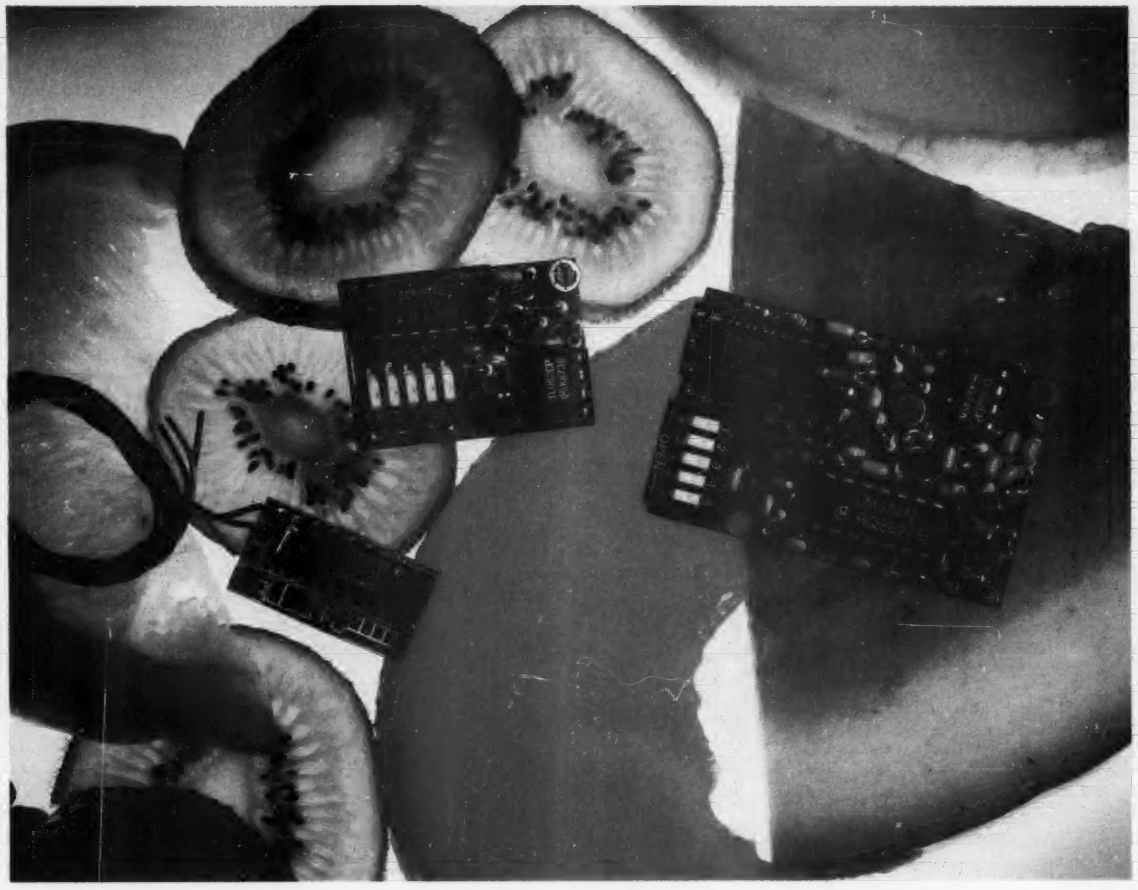
I built an interface panel to control the whole thing. I brought out the antenna connector to an accessible point, away from the buried radio. I routed the audio output from the radio so that I could listen to the channel. In addition I installed power connectors to charge the battery, and charge the laptop off the main battery, as well as fuses and power switches to protect the whole thing.

A cast metal Budd box serves as the mounting plate for all this hardware. A one-inch speaker and a toggle switch provide channel audio when required. A simple one-resistor charger supplies current to the laptop when needed to charge the computer battery.

Finally, a jumper cable routes the antenna line from this interface panel to the antenna mounting plate at the top of the BackPacket. I cut a bracket of 0.062-inch aluminum that rests between the top of the Ensolite laminate and the packcloth. Gravity holds the bracket in when the BackPacket lies flat; when in transit, the two closure zippers on the main bag hold the plate in, but still allow the antenna connector to project out of the bag so that you can connect either an antenna cable or a rubber duck antenna.

Accessories

The BackPacket still needed some acces-



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sories. The laptop, and to a much lesser extent the TNC, generated a great deal of RF noise. This caused a very high receiver noise level in the radio, located no more than an inch or so from either. Moreover, when a rubber antenna was attached to the connector at the top of the BackPacket, the noise level climbed quite high. At this noise level it required signals of many microvolts to produce readable packets. I needed a transportable, easy antenna that was also very durable.

I built a simple rope dipole. Starting with 20 feet of RG223 cable, I stripped off 19 inches (quarter-wave at 2 meters) of the shield from one end of the cable. Then I slipped on a 19-inch piece of braid over that end and slid it down so that it formed an electrical dipole, with the outer jacket of the cable forming an insulator between the coax shield and the added braid. Liberal use of polyvinyl tubing and heat-shrink polyolefin tubing sealed the whole antenna and made it quite durable. A rubber ring eye at the end of the dipole provided a hook for hanging the antenna from a branch or rope. A BNC connector at the other end completed the antenna.

I needed a wall charger for the main battery, various adapter cables and connectors for a variety of installations, a TNC instruction book, plus writing instruments and paper. I also packed a clip-on, battery-powered reading lamp with a gooseneck so that the LCD screen could be read in the dark. The lamp also provided enough illumination to work the keyboard well. A magnetic-base mobile 2 meter quarter-wave antenna completed the suite. All these accessories were packed in a couple of nylon stuff sacks to keep the small parts from wandering away.

Final weight of the BackPacket, with all accessories included, is about 25 pounds. However, since it is carried on the back, it is a minor encumbrance; the most important thing is that it can be counted on to work and work well in almost any environment or location.

Future Plans

Future modifications to the unit may include some sort of LCD meter that indicates battery voltage. Also, it would be handy to know if someone has connected to the BackPacket even with the computer off. I can achieve that either by building a small circuit within the TNC that will generate an audio beep tone on the local speaker, or less invasively, by constructing an optically-coupled sensor that monitors the status of the CONNECT lamp, and generates the same beep tone if the lamp lights up. In addition, I'd like to try some of the latest micro-size TNCs and miniature HTs now available. This would certainly help to reduce the current drain and overall weight of the system.

But for now, the BackPacket, along with a suitable digipeater, provides an excellent and reliable communication method anywhere that I can hike, climb or bike.

Jon Trent Adams NW6H, 1139 S. Truro St., Inglewood CA 90301.

HF Equipment	Regular	SALE
IC-765 Xcvr/ps/keyer/auto tuner.....	3149.00	**2699**

IC-781 Xcvr/Rcvr/ps/tuner/scope 6149 **5199**

IC-751A 9-band xcvr/.1-30 MHz rcvr	1699.00	**1399**
PS-35 Internal power supply.....	219.00	**199**^{95}
FL-63A 250 Hz CW filter (1st IF).....	59.00	
FL-52A 500 Hz CW filter (2nd IF)....	115.00	**109**^{95}
FL-53A 250 Hz CW filter (2nd IF)....	115.00	**109**^{95}
FL-70 2.8 kHz wide SSB filter.....	59.00	

IC-735 HF xcvr/SW rcvr/mic.....	1149.00	**969**^{95}
PS-55 External power supply	219.00	**199**^{95}
AT-150 Automatic antenna tuner	445.00	**389**^{95}
FL-32A 500 Hz CW filter.....	69.00	
EX-243 Electronic keyer unit.....	64.50	
UT-30 Tone encoder	18.50	
IC-725 HF xcvr/SW rcvr..... *(Special)*	949.00	**799**^{95}
AH-3 Automatic ant tuner .. *(Special)*	489.00	**379**^{95}
IC-726 10-band xcvr/6m/.5-30MHz rx	1299.00	**1089**

Accessories	Regular	SALE
IC-2KL HF solid state amp w/ps.....	1999.00	**1699**
IC-4KL HF 1KW out s/s amp w/ps.....	6995.00	**5995**
EX-627 HF auto. ant. selector *(Special)*	315.00	**269**^{95}
PS-15 20A external power supply	175.00	**159**^{95}
PS-30 Systems p/s w/cord, 6-pin plug	349.00	**319**^{95}
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SP-7 Small external speaker	51.99	
CR-64 High stab. ref. xtal; 751A, etc ...	79.00	
SM-6 Desk microphone	47.95	
SM-8 Desk mic - two cables, scan	89.00	
AT-100 100W 8-band auto. ant. tuner ...	445.00	**389**^{95}
AT-500 500W 9-band auto. ant. tuner ...	589.00	**519**^{95}
AH-2 8-band tuner w/mount & whip	758.00	**689**^{95}
AH-2A Ant tuner system, only .. *(Special)*	559.00	**469**^{95}
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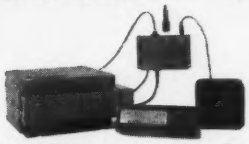
IC-275H 100w 2m FM/SSB/CW.....	1399.00	**1199**
IC-475A 25w 440 FM/SSB/CW w/ps	1399.00	**1199**
IC-475H 100w 440 FM/SSB/CW *(Spec)*	1599.00	**1269**
IC-575A 25w 6/10m xcvr/ps *(Special)*	1399.00	**1099**
IC-575H 25w 100w 6/10m xcvr.....	1699.00	**1469**

VHF/UHF Mobile Transceivers	Regular	Sale
IC-229A 25w 2m FM/TTP mic	449.00	**389**^{95}
IC-229H 50w 2m FM/TTP mic	479.00	**419**^{95}
IC-448A 25w 440 FM/TTP ... *(Closeout)*	599.00	**499**^{95}

Dual-band FM Transceivers	Regular	Sale
IC-3220A 25w 2m/440 FM/TTP mic...	659.00	**569**^{95}
IC-3220H 45w 2m/35w 440 FM/TTP	699.00	**599**^{95}
IC-2400A 2m/440 FM/TTP ... *(Special)*	899.00	**699**^{95}
IC-2500A 35w 440/1.2GHz FM.....	999.00	**869**^{95}



Multi-band FM Transceiver	Regular	Sale
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UX-R91A Broadband receiver unit...	389.00	**349**^{95}
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UX-59A 10w 6m unit.....	349.00	**319**^{95}
UX-S92A 2m SSB/CW module.....	599.00	**529**^{95}
UX-39A 25w 220MHz unit *(Special)*	349.00	**279**^{95}
UX-129A 10w 1.2GHz unit	549.00	**499**^{95}

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IC-970A 25w 2m/430 MHz transceiver	2895.00	**2499**
IC-970H 45w 2m/430 MHz transceiver	3149.00	**2699**
UX-R96 50-905 Mhz receive unit....	389.00	**349**^{95}

Mobile Antenna	Regular	Sale
AH-32 2m/440 Dual Band mobile ant	39.00	
AHB-32 Trunk-lip mount.....	35.00	
Larsen PO-K Roof mount	23.00	
Larsen PO-TLM Trunk-lip mount	24.70	
Larsen PO-MM Magnetic mount	28.75	

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RP-2210 220MHz 25w repeater	1649.00	**1399**
RP-4020 440MHz 25w repeater	2299.00	**1999**
RP-1220 1.2GHz 10w repeater.....	2599.00	**2249**

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IC-3SAT 220 HT/TTP	449.00	**369**^{95}
IC-4SAT 440 HT/TTP	449.00	**369**^{95}
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IC-4GAT 440MHz, TTP	449.00	**369**^{95}
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IC-32AT 2m/440 HT	629.00	**549**^{95}
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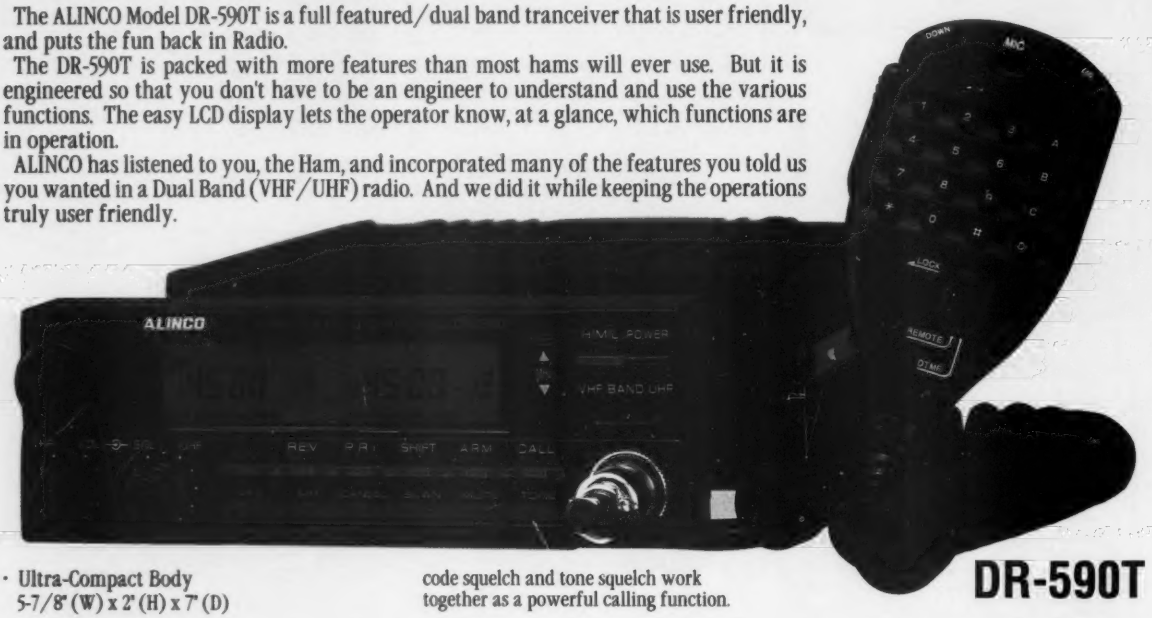

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- **Simultaneous**
  Receiving on both bands at the same time
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- **Remote Control Microphone**
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  3. Shifting to call mode
  4. ARM (Automatic Repeater Mode)
  5. VHF/UHF Switching
  6. Up/Down by 1 Mhz steps
  7. Setting and Selecting DSQ codes
  8. Setting and Automatic Dialer
- **Scanning Features**
  Memory Scan, Program Scan, ARM Scan, Band Scan, and more Scan.
- **Memory Channels**
  The unit has 28 memory channels, one independent "Call" channel, and 10 ARM memory channels (40 channels in total). You can program set tones, shift frequences, shift directions, and channel steps in each of the 28 memory channels.
- **ARM (Automatic Repeater Memory) Function**
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- **ABX (Automatic Band Exchange) Function**
- **Bell Function**
- **Dimmer Function**
  Selectable 2 different brightness of LCD light
- **Three Priority Functions**
  VFO Priority, Memory Priority and Call Priority.
- **Repeater Operation**
  The DR-590T can be used as a cross band repeater.
- **Full Duplex Cross band Operation**
- **Others**
  1. Auto Dialer Function
  2. 6 Channel Steps (5/10/12.5/15/20/25 Khz)
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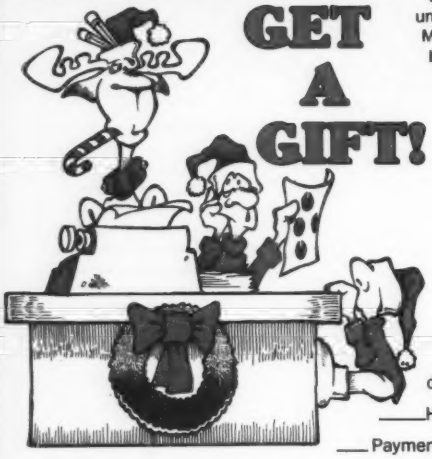

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The Pitch: *73* wants to know what you want to read. Help us by voting on this month's features and columns—you'll find their numbers in the Feedback box on the page preceding this card.

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In our continuing effort to present the best in amateur radio features and columns, we recognize the need to go directly to the source—you, the reader. Articles and columns are assigned feedback numbers, which appear on each article/column and are also listed here. These numbers correspond to those on the feedback card opposite this page. On the card, please check the box which honestly represents your opinion of each article or column.

Do we really read the feedback cards? You bet! The results are tabulated each month, and the editors take a good, hard look at what you do and don't like. To show our appreciation, we draw one feedback card each month and award the lucky winner a free one-year subscription (or extension) to *73*.

To save on postage, why not fill out the Product Report card and the Feedback card and put them in an envelope? Toss in a damning or praising letter to the editor while you're at it. You can also enter your QSL in our QSL of the Month contest. All for the low, low price of 25 cents!

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1 Letters
2 Never Say Die
3 QRX
4 Behold the BackPacket!
5 Ham Profiles
6 Upgrade Your HD-4040
7 Review: Ten-Tec Hercules II
8 The VOX Plus
9 Review: Lightning Bolt Dual-Band
10 Review: PacComm PSK-1
11 Pack Your Seabag, "Sparks"
12 Review: ICOM IC-726
13 Dealer Directory
14 RTTY Loop
15 Looking West
16 Hams with Class
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32 Random Output
33 Propagation
34 Review: PT-340 Tuner-Tuner

HAM PROFILES

There are no "average" hams!

Photo A. Left to right: Gena UA9MA, Chuck (Charles Emily) W1NW, and Serg UA9MC, visiting W1NW in November 1989. They are holding trophies W1NW 5BAND DXCC, 5BAND WAZ, 5BAND WAS.

Greetings from West Siberia

Gennady Kolmakov UA9MA writes us that he found out about amateur radio when he was a freshman in the Institute of Railroad Engineers in 1972. At that time, there was an active collective radio station, UK9MBA, at the institute. He soon received his personal call, UA9MAF, and he built his first directional antenna. Since then, his main interests have been DXing and contesting. In the near future, he plans to learn about RTTY and packet.

Olga, his wife, doesn't share his interest in amateur radio, although she accepts his hobby with respect and understanding. But his sons, nine-year-old Mike and six-year-old Alex, are successfully studying CW.

Besides radio, Gennady is interested in music. He likes all kinds of American contemporary music, such as all forms of jazz.

Currently, he is vice-president of the West Siberia DX Club and he spends much time doing the administrative and organizational work. In particular, he's arranging a DXpedition to one of the far regions of the U.S.S.R. He's also QSL manager for radio stations 4K2OIL, 4K2BDU, 4K2OKV, 4K2BAZ, and 4K4AB.

"I'd like to use this occasion to send through your journal my warmest wishes to all American ham radio fans. I'd like to hope that radio helps people of our planet to understand each other better and bring peace to the world." *TNX, Gennady, for your greetings and wishes. Also, thank you for sending examples of the beautiful awards of the West Siberia DX Club, which we were happy to publish in "73 International" from October 1989 until the summer of 1990.*

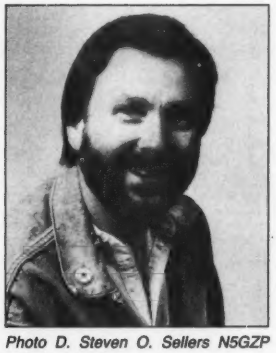

Photo D. Steven O. Sellers N5GZP wins journalism awards.

From Interest to Career

Licensed as an amateur radio operator at the age of 12, Steven O. Sellers' interest in the hobby led to his first job—in broadcasting at a small, local station in his hometown of Kenedy, Texas, when he was 15.

Steve N5GZP is active on 10 meters. He's a member of TEN-X International, the ARRL, and the Palomar Amateur Radio Club in the North County region of San Diego.

Recently, United Press International presented Steve with two broadcasting awards for two radio documentaries he produced and reported. The awards were for best investigative documentary in the Western Region and outstanding achievement in reporting in the Western Region. *TNX KGMG-AM/FM.*

Photo B. Off to a good start, six-year-old Terry Van Sickle KB5NTC plans to get his Extra in a few years.

Going Far—Fast

The Plano Amateur Radio Klub (PARK) congratulates Terry Van Sickle, son of Brenda N5LEU and Terry Sr. WB5WXI, on passing the Novice Class amateur radio exams last August. Six-year-old Terry had been studying in a class taught by Tad Derx N5ODR. The class, sponsored by PARK, had 45 students!

Since Terry KB5NTC couldn't write fast enough to copy Morse code by hand, he passed his code test by typing the code test portion on a laptop computer.

Terry is a first grader at The Greenhill School in Addison, Texas. He's interested in learning how to work amateur satellites. He hopes to have his Extra Class by the time he's 10 or 11. *TNX John T. Beadles.*

Let's Talk!

Bob Weinstein KE2FE, assistant principal of Richmond Hill High School, says that these high school students love to talk with other high school students and they QSL "100% directly." They rapidly become disenchanted when all they get is "59 old man, QSL via the bureau..." during contests. To Wayne, KE2FE says, "I really agree with your idea about limiting credits for DXCC to certain contest dates."

Photo C. Bob Weinstein KE2FE (far back, on the right) and his class of high school hams.

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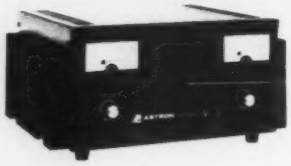

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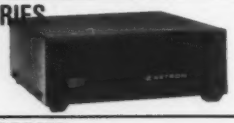

MODEL	Colors Gray	Colors Black	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
• LOW PROFILE POWER SUPPLY						
SL-11A	•	•	7	11	2¾ x 7⅝ x 9¾	11

RS-L SERIES

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
• POWER SUPPLIES WITH BUILT IN CIGARETTE LIGHTER RECEPTACLE				
RS-4L	3	4	3½ x 6⅛ x 7¼	6
RS-5L	4	5	3½ x 6⅛ x 7¼	7

RM SERIES

MODEL RM-35M

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
• 19" RACK MOUNT POWER SUPPLIES				
RM-12A	9	12	5¼ × 19 × 8¼	16
RM-35A	25	35	5¼ × 19 × 12½	38
RM-50A	37	50	5¼ × 19 × 12½	50
RM-60A	50	55	7 × 19 × 12½	60
• Separate Volt and Amp Meters				
RM-12M	9	12	5¼ × 19 × 8¼	16
RM-35M	25	35	5¼ × 19 × 12½	38
RM-50M	37	50	5¼ × 19 × 12½	50
RM-60M	50	55	7 × 19 × 12½	60

RS-A SERIES

MODEL RS-7A

MODEL	Colors Gray	Colors Black	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
RS-3A		•	2.5	3	3 × 4¾ × 5¾	4
RS-4A	•	•	3	4	3¾ × 6½ × 9	5
RS-5A		•	4	5	3½ × 6⅛ × 7¼	7
RS-7A	•	•	5	7	3¾ × 6½ × 9	9
RS-7B	•	•	5	7	4 × 7½ × 10¾	10
RS-10A	•	•	7.5	10	4 × 7½ × 10¾	11
RS-12A	•	•	9	12	4½ × 8 × 9	13
RS-12B		•	9	12	4 × 7½ × 10¾	13
RS-20A	•	•	16	20	5 × 9 × 10½	18
RS-35A	•	•	25	35	5 × 11 × 11	27
RS-50A	•		37	50	6 × 13¾ × 11	46

RS-M SERIES

MODEL RS-35M

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
• Switchable volt and Amp meter				
RS-12M	9	12	4½ × 8 × 9	13
• Separate volt and Amp meters				
RS-20M	16	20	5 × 9 × 10½	18
RS-35M	25	35	5 × 11 × 11	27
RS-50M	37	50	6 × 13¾ × 11	46

VS-M AND VRM-M SERIES

MODEL VS-35M

• Separate Volt and Amp Meters • Output Voltage adjustable from 2-15 volts • Current limit adjustable from 1.5 amps to Full Load

MODEL	Continuous Duty (Amps) @13.8VDC	@10VDC	@5VDC	ICS* (Amps) @13.8V	Size (IN) H × W × D	Shipping Wt. (lbs.)
VS-12M	9	5	2	12	4½ × 8 × 9	13
VS-20M	16	9	4	20	5 × 9 × 10½	20
VS-35M	25	15	7	35	5 × 11 × 11	29
VS-50M	37	22	10	50	6 × 13¾ × 11	46
• Variable rack mount power supplies						
VRM-35M	25	15	7	35	5¼ × 19 × 12½	38
VRM-50M	37	22	10	50	5¼ × 19 × 12½	50

RS-S SERIES

MODEL RS-12S

• Built in speaker

MODEL	Colors Gray	Colors Black	Continuous Duty (Amps)	ICS* Amps	Size (IN) H × W × D	Shipping Wt. (lbs.)
RS-7S	•	•	5	7	4 × 7½ × 10¾	10
RS-10S	•	•	7.5	10	4 × 7½ × 10¾	12
RS-12S	•	•	9	12	4½ × 8 × 9	13
RS-20S	•	•	16	20	5 × 9 × 10½	18

*ICS—Intermittent Communication Service (50% Duty Cycle 5min. on 5 min. off)

CIRCLE 16 ON READER SERVICE CARD

Upgrade Your HD-4040

KISS your Heath HD-4040 and keep AX.25 too!

by Mark Dieter N2BLI

I was in the mood to try something new. I had a copy of KA9Q's Internet package for my Macintosh, but my old TNC would not support it (it requires KISS). I didn't want to invest lots of money in a new TNC, and I knew a KISS upgrade would not allow me to use the TNC in normal AX.25 mode. I have an excellent terminal program that would be useless without a full-function TNC. I wanted both, and I didn't want to spend any money. Sound familiar? So I put the little gray cells to work and this is what I came up with.

The KISS

KISS (Keep It Simple Stupid) provides direct computer-to-TNC communications using a simple protocol. Normal TNCs were designed to interface with humans, not computers. By designing the TNC for humans, it actually makes it harder to interface the TNC to computer applications. KISS removes many of those restrictions by placing most of the TNC functions within the attached computer. A KISS TNC only converts between asynchronous data for the computer to synchronous HDLC (High Level Data Control) for the radio, and it controls the transmitter. This allows the computer to maintain multiple connects, run new protocols, and other advanced functions. Some software packages like bulletin boards, TCP/IP (the KA9Q software), and others require a KISS TNC.

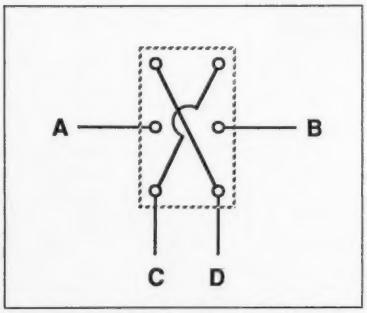

Figure 1. DPDT switch wiring details.

The TNC 1 KISS upgrade from TAPR consists of a single EPROM. It costs about $12. For normal installation, the new EPROM would replace the existing EPROM at hex address $E000. That's U12 in the Heath HD-4040. If you replace that EPROM with the KISS one, your TNC will work fine in KISS mode. It's not even necessary to remove the other original EPROM chips. The TNC will ignore them. Of course, your TNC will not be able to operate in its normal AX.25 mode. But remember, we're not willing to give up our normal TNC functions for a KISS!

Making It Work

What if we could mount both EPROMS in the TNC? Then all we have to do is find a way to switch between the two EPROMS, right? Lucky for us there is already a socket in the TNC for an additional RAM or ROM chip—U8. So mounting the new chip is easy. But these EPROMS have 28 pins. How can we switch them all? The answer is: We don't have to! All the address, data, and control signals, except one (more about that later), are the same as U12. The only problem left is that the starting memory address of U8 is 4000. The KISS EPROM must be installed at address $E000.

All devices that communicate with the microprocessor have specific addresses assigned to them. The address decoding circuits ensure that the correct device is "enabled" when it is addressed by the microprocessor. Each ROM chip makes up one 8-kilobyte segment of the entire memory. The starting address of each chip (8-kilobyte segment for ROM) is determined by the address decoder U4. This IC decodes the high bits of the address from the microprocessor and produces a chip select signal to the memory device that holds the particular memory location the microprocessor wants. The chip select "enables" a particular memory chip and

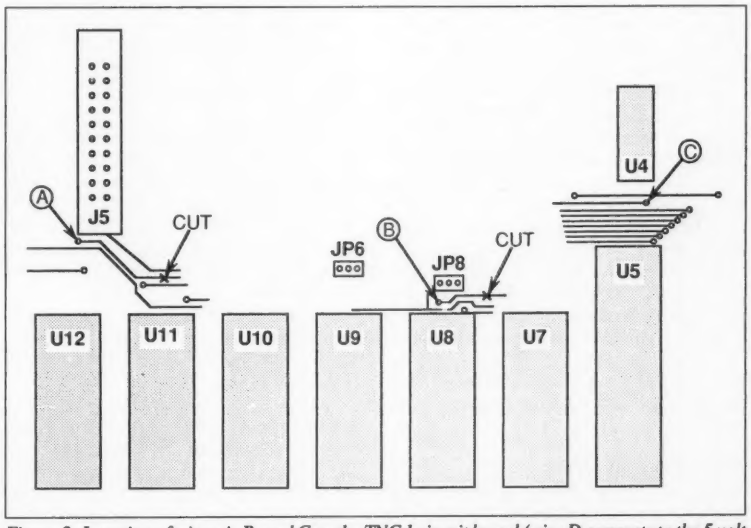

Figure 2. Location of wires A, B, and C on the TNC 1 circuit board (wire D connects to the 5 volt bus).

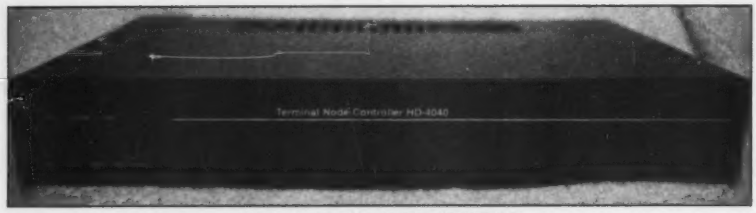

Photo A. The Heath HD-4040 TNC.

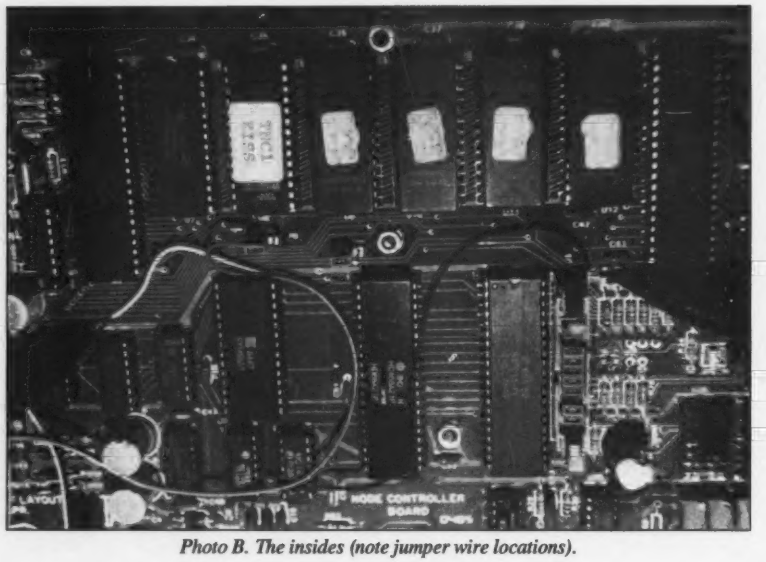

Photo B. The insides (note jumper wire locations).

allows it to react to the address, control, and data signals from the microprocessor. Essentially, it turns the chip on or off. Remember, I said there is only one signal that is different between U8 and U12. Yep, you guessed it! It's the chip select.

What we want to do is re-map the starting address of chip socket U8 (starting address $4000) to U12 (starting address $E000). This can be done quite easily by connecting the chip select signal for U12 to the chip enable pin on U8, then cutting the normal chip select traces from U4 to U8 and U4 to U12. The chip select of the unused EPROM must be tied to +5V. This effectively disables the chip and removes it from the circuit.

By doing this we can make U8 have a starting address of $E000, and we can disable U12. If we take the chip select signal for U12 and switch it between U12 and U8 (and switch the unused chip to +5V) we can switch which EPROM is seen by the microprocessor at address $E000.

So it turns out that we only need to switch one signal, the chip select. When we flip the switch and toggle the address $E000 between socket U8 and U12, we toggle between KISS and AX.25 mode.

Installation—Step by Step

Very few parts are required to install this upgrade in your TNC: the TAPR KISS TNC 1 EPROM, a good quality DPDT switch, and a few strands of small-gauge wire (ribbon conductor works great).

In the following instructions I will be referring to positions on the TNC circuit board. It is important that we have a common reference to locate items on the board. All my instructions will refer to the board, looking at it from the component side, with front toward the front of the cabinet (LEDs are mounted in the front of the board).

First, open the HD-4040 case. Find a spot in the case to locate the DPDT switch. Make sure it will clear the board and all components. I put mine in back near the power regulator.

Second, remove the circuit board. When you make the hole for the switch you will be making lots of aluminum filings which could short components on the board. To remove the board you must remove seven nuts holding the board in, and unplug the 7-pin power plug J4. Gently pull the front LEDs back to clear the case.

Next, put a hole in the case for the switch. Depending on the size and type of switch you have, the method will vary. Then reinstall the board into the case.

Locate U4, U8, and U12. Everything should be marked on the circuit board. Carefully install the TAPR TNC 1 KISS EPROM into socket U8. The notch end should match the notch shown on the circuit board. Make sure you do not bend any of the pins!

Solder four 9-inch wires onto the DPDT switch, as shown in Figure 1. Mount the DPDT switch into the case. Insert wire "A" into the hole in the circuit board, near the front left corner of J5, and solder. (See Figure 2.) Take your time—the hole is very tiny.

Insert wire "B" into the hole in the circuit board directly forward of the left-most pin of JP8, and solder. Insert wire "C" into the hole forward of U4 slightly to the right of its centerline (it's the closest hole to U4 towards the front), and solder.

Insert wire "D" into one of the holes in the +5V bus (on the front right-hand side), and solder. Locate the circuit trace from U4 pin 9 to U12 pin 20. Since the board has traces on both sides it's not obvious. It is the same trace that wire "A" is connected to. (See Figure 2.)

Now, the tricky part. Take a very fine-tipped knife or scribing tool and cut the trace somewhere to the right of where wire "A" is connected. I found that a scraping motion was most effective. Make sure the trace is cut completely through.

Locate the circuit trace from U4 pin 2 to U8 pin 20. It is the same trace that wire "B" is connected to. (See Figure 2.) Cut the trace to the right of where wire B is connected. Place jumper JP6 to the right. Place jumper JP8 to the right.

Operation

With the upgrade in place, you're ready to try it out. Power-up your favorite terminal emulator and the TNC. If you don't see the normal welcome message from your TNC, power the unit off, flip the "Normal / KISS" switch, and turn it back on. One position or the other will be the normal mode. **CAUTION**: I recommend that you always turn the TNC off when changing the "Normal / KISS" switch. In normal mode your TNC should behave exactly as before, without so much as a changed parameter.

To try out your TNC's new-found capabilities, you will of course need KISS software. Unfortunately, TAPR did not provide instructions with my EPROM. I found out that the TNC in KISS mode is fixed at 4800 baud, 8 data bits, no parity, and 1 stop bit. Your KISS software is probably already configured for that setup. None of the normal TNC settings have any effect on KISS operation. Remember all those TNC functions are done in your computer in KISS mode. If you have the optional Heath HDA-4040-1 TNC status indicator, the indicator LEDs will not work in KISS mode.

Postscript

Unfortunately, this upgrade uses up the socket for additional RAM (I wasn't going to add more anyway), but nothing is completely free, right?

The KISS EPROM as well as the KA9Q Internet Software Package is available from TAPR. To get an order form write to: *Tucson Amateur Packet Radio, P.O. Box 12925, Tucson AZ 85732; (602) 749-9479.*

You may contact Mark Dieter N2BLI at 86 Hiddenwood Dr., Rochester NY 14616.

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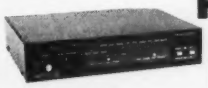

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73 Review

by C. Drayton Cooper III, N4LBJ

Ten-Tec's Hercules II Model 420

Turn your rig into a 550 watt transceiver!

Ten-Tec, Inc.
Highway 411 East
Sevierville TN 37862
Phone: (615) 453–7172
Model 420: $1275.
Power supply 9420: $795.

Ten-Tec's new Hercules II solid state linear amplifier fills an important niche in the equipment line-up available to today's ham, and does it with elegance and technological appropriateness. I have operated the model 420, as the Hercules II is known at Ten-Tec, since March 1990, and it has performed up to specs every time I've turned it on. It is extremely easy to drive, requiring only 35–50 watts input to produce the full rated output of 550 watts. It is exceedingly quiet. It is, far and away, the simplest amplifier to operate that I've ever used.

The Medium Power Niche

First, a word about its power output capability. The 420 is not a classic "rock crusher." The ham who chooses the Hercules II should realize from the outset that this is a medium-power amplifier.

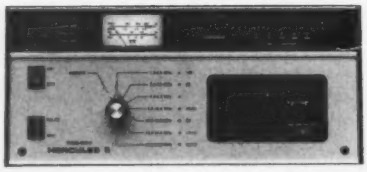
There is definitely a place for a medium-power amplifier in today's world. The rules and regulations we operate under stress the importance of running only enough power to maintain satisfactory communication. It's very difficult to run a 1500-watt amplifier at much less than full output without developing problems of reduced thermal efficiency in the final tubes. Generally speaking, reliable communications can be maintained at much less power than the maximum allowable by law. It should be noted that the difference between a 500 watt power level and the full legal limit of 1500 watts will only raise your signal a little less than an S-unit. That extra S-unit can be costly if you look at the price of a full-power amplifier.

Quiet, Easy, and Fast

For years, solid state technology has been portrayed as basically simple, straightforward, and highly reliable. Yet with a few notable exceptions, we have used the benefits of solid state technology only in QRP rigs and in transceivers up to the 100–150 watt class.

The Hercules II provides us with an opportunity to use the positive characteristics of solid state devices in a kilowatt-input-class amplifier. And the benefits are quickly recognizable the minute you switch on the 420. It is incredibly quiet, amazingly easy and simple to operate, and it provides instantaneous QSK, or full break-in CW!

Complete set-up of the 420 can be accomplished in about 15 minutes. Open the box,



take out the RF deck, make the three interconnections to the transceiver, screw in the PL-259 from the antenna, connect the power supply cable, and you're ready to operate. It's honestly that simple.

A No-Sweat Amp

Assuming you have an SWR of less than 2:1 on your feedline, you just turn it on and talk. There's no warm-up period, no waiting for capacitors in the power supply to charge up, no tube filaments to heat. And there's no grid drive to peak or final circuit to dip. If you're the type who enjoys fiddling with his gear, this may be disconcerting at first. But believe me, it's a welcome change after years of worrying about too much, or too little, grid current; about whether or not the final was loaded up "tightly" enough; or about a fatal parasitic wiping out a $200 tube!

Since the theory of how Ten-Tec achieves 1000 watts input with 12-volt transistors has been thoroughly covered elsewhere, I won't get into that. Suffice it to say that they do, and if something were to go wrong, the transistors would be much less expensive to replace than 50-volt models.

The 9420 Supply—Heavy is the Word

Another feature of the Hercules II that should appeal to many in today's space-conscious age is its size. The 420 takes up no more space in your shack than a full-sized transceiver. In fact, the Hercules II essentially matches the Ten-Tec Paragon or Omni-V transceivers for compactness.

To accomplish this, the RF deck and the power supply had to be separated, as in the tradition of the Ten-Tec Titan amplifier. Herein lies the only disadvantage that I have discovered in the system. Naturally, a power supply capable of providing enough current at 12–14 volts DC to run a kilowatt-input linear has to be *heavy*. Unfortunately, the 9420 supply is over the UPS weight limit and must be shipped separately from the RF deck of the amplifier. Larry Worth, Ten-Tec's service manager, told me that technicians at the factory have successfully run a 420 on a heavy-duty car battery and an automatic trickle charger. In some of their advertising, Ten-Tec suggests this as an alternate way of powering the Hercules II. It certainly would be a less expensive way to go.

However, my experience with the 420–9420 system since last March leads me to recommend biting the bullet and going with the complete package. As heavy as the 9420 is, it can be conveniently placed out of the way. Since it is controlled by the on-off switch on the amplifier, constant access to it is not necessary. Just put it where air can circulate around its heat sinks.

Incidentally, the 9420 is wired so that it can provide power for a 100-watt class transceiver as well as the 80-amp amplifier. Believe me, you don't have to worry about whether it's stout enough to handle both the amp and your rig.

Remote Control Feature

A final feature of the 420 should be mentioned. Ten-Tec designed the amplifier so that it can be fully remote-controlled. They provide a remote head for the unit, and you can connect the RF deck to the head with a 12-foot multi-conductor cable. The remote head, which contains all the function controls found on the front panel of the amplifier, including the LED-driven PEP output indicator, can be placed on the operating desk, and the amplifier itself can then be situated in any location the operator chooses.

This feature was originally designed so that the 420 could be operated as a mobile amplifier (RF deck in the trunk, remote head under the dash), but it may also be a valuable feature for anyone whose shack is small.

Since first using a linear back in the early '60s (a home-brew pair of 4-400s), I have sampled a variety of the breed. Each of them needed some degree of special handling to get it to perform up to snuff. Thus far, however, the 420 is the first amplifier I have ever used that actually feels and acts like an extension of the transceiver itself. In fact, using it makes me feel like I'm running a 550-watt transceiver. 73

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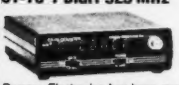

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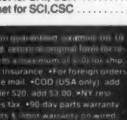

Fantastic receiver that captures the world with just a 12" antenna! Can receive any 2 MHz portion from 4–11 MHz. True superhet has smooth varactor tuning, AGC, RF gain control, plenty of speaker volume and runs on a 9V battery. Fascinating SCKI, school or club project provides hours of fun for even the most serious DXer. For the car, consider our shortwave converter. Two switchable bands (in 3–22 MHz range), each 1 MHz wide—tunable on your car radio dial. Add some interest to your drive home!
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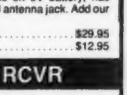
FM STEREO TRANSMITTER

STEREO



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CIRCLE 34 ON READER SERVICE CARD

The VOX Plus HT Accessory

Enjoy base station performance—with your HT!

by Mike Kossor WA2EBY

After a long, busy season of fleamarketeering, I managed to reallocate sufficient funds to finally invest in a 2 meter rig. With all the fine equipment available, the selection wasn't easy. I wanted a rig that I could take with me to hamfests, operate mobile, and use at home. The obvious choice? A full-featured handi-talkie, of course!

The handheld I chose was perfect for taking to hamfests. I added the optional speaker mike, plugged the external 12 volt DC power cable into the cigarette lighter jack, made a mounting bracket, and enjoyed excellent mobile operation as well. But when I tried operating the unit at home, it became apparent I was having to compromise.

Unhandy Talkie

During a recent VHF contest, I found myself joggling the HT, logbook, and pen, trying to log and call CQ. I did my best at making contacts running a mere 2.5 watts RF output. Being limited to a single mode, FM, took its toll on my score, since I was unable to make CW contacts worth bonus points. I did try operating MCW (Modulated CW) using the tone pad, but the battery started dying during the awkward QSO.

With the battery gone, and out of the contest, I had plenty of time to think about how nice it would be to operate VOX on the handheld, as I do on my HF gear. Logging would be so much easier. It would also be nice to operate MCW with a real key, and transmit the full 5 watt RF output available without having to worry about taxing the batteries to exhaustion.

It also occurred to me that an MCW mode would be especially useful to individuals with Technician Class licenses who only have FM transceivers. How could they upgrade without practicing CW?

My thoughts soon turned to action. My goal was to design an add-on accessory that could provide these desirable features, at a cost and complexity well within the realm of the average radio amateur.

Features of the VOX Plus

What evolved is the VOX Plus. This accessory uses the external microphone, speaker, and power jacks of a transceiver, and adds the features of VOX operation or break-in MCW. It uses a clean 800 Hz sine wave oscillator complete with sidetone. A programmable regulated power supply is also available to power transceivers requiring six to ten 500 mAh NiCd batteries, at full RF power output.

Photo A. The VOX Plus setup. (Photo by Eric Wagner.)

These features resolved the initial shortcomings of HT base station operation. However, since I was using an external speaker, I decided to add an active audio filter, too. This way I could separately adjust the low and high frequency response of the received audio. Compensating for poor frequency response of transmitted or re-transmitted signals, I could customize the received audio for optimum readability, and also use the filter to attenuate annoying CTCSS tones, if present. A 2 watt audio power amp was added to provide sufficient audio output.

One final feature I thought desirable was an audio tape interface for MCW. With this interface, taped bulletins or code practice can be sent with full break-in operation.

Circuit Overview

The VOX Plus circuit is a combination of transistor switches and common op amp circuits described in detail in many textbooks. Two good books on the subject are *Analysis and Design of Integrated Electronic Circuits*, by Paul M. Chirlian (chapters 13, 14 and 18), and *Basic Electronics*, by Michael M. Cirovic (chapters 14 and 15). The circuit does get a bit cumbersome when all the individual circuits are grouped together. However, Figure 1, a functional block diagram, should give you a general idea of how the system operates.

Referring to Fig. 1, VOX operation requires MODE switch S1 to be in the voice position. Switch S1A disables the MCW oscillator while segment S1B connects the transceiver's microphone input to the VOX Plus microphone amplifier. The circuit is considered to be in an idle state when the operator is not talking and the transceiver is not receiving any signal.

In this state, the positive input of comparator U2C is biased at 50% of the supply voltage, +0.5V, and the negative input is biased at +0.6V. The output of comparator U2C is low (0 volts) because the negative input is at a higher potential than the positive input. The re-triggerable monostable multivibrator (or "one-shot") is also in an idle or stable state with its output low because it has not received a positive trigger voltage from comparator U2C. PTT switch Q3, controlled by the one-shot, is in the open state, placing the transceiver in the receive mode.

Transmit Mode

When the operator begins talking, the voice is picked up by the internal VOX Plus electret microphone and amplified by U1A. The signal is then applied to the input of VOX amp U1B via switch S1B for further amplifi-

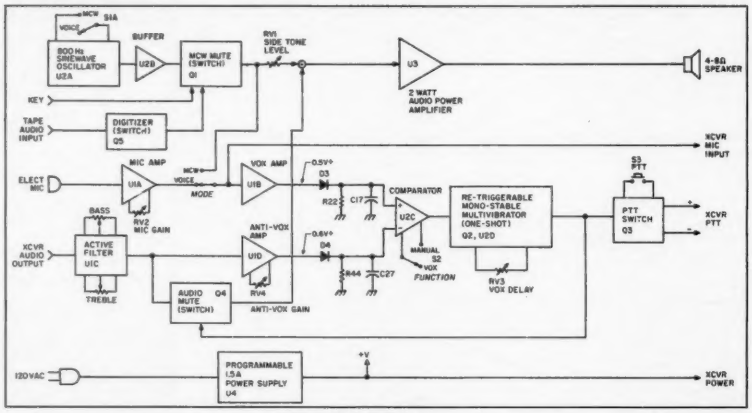

Figure 1. Block diagram.

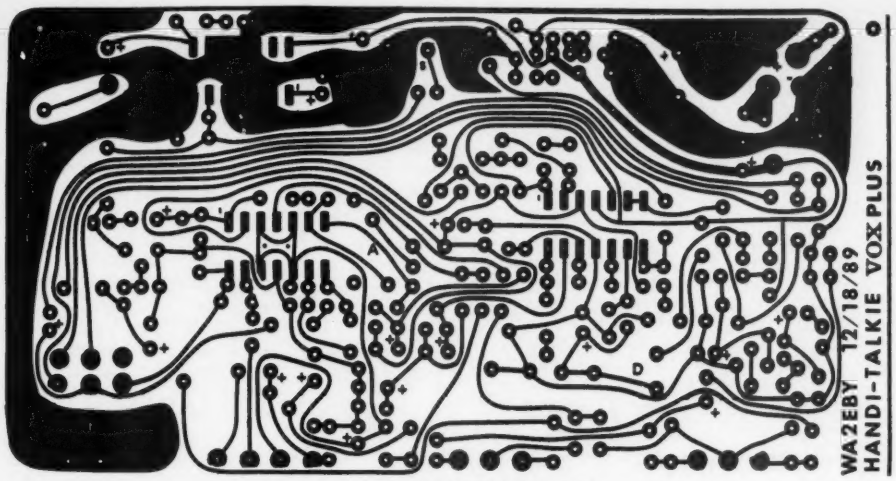

Figure 2. PC board foil pattern.

cation. The highly amplified voice signal at the output of VOX amp U1B is then rectified by diode D3.

The positive peaks of the rectified audio charge capacitor C17, which is connected to the positive input of comparator U2C. The +0.5V DC bias level normally present on the positive input of U2C increases in direct proportion to the amplitude of the operator's voice.

When the voltage level increases to about +0.7V, it exceeds the +0.6V value present on the negative input of U2C, and the comparator's output goes high (+V volts). This in turn triggers the one-shot and turns on PTT switch Q3, keying the transceiver. The output of the one-shot is also used to turn on audio MUTE switch Q4 to eliminate "pops" in the speaker when switching from receive to transmit and back to receive.

A sample of the operator's voice is fed to the microphone input of the transceiver and transmitted out. The transceiver will remain keyed as long as the operator's voice is of sufficient amplitude to keep capacitor C17 charged, maintaining the positive input of comparator U2C at a higher level than the negative input. When the operator's voice ceases, capacitor C17 discharges quickly through resistor R22, and the positive input of comparator U2C returns to its normal value of +0.5V.

Upon reaching its normal value, the circuit is back in the idle state, which causes the output of comparator U2C to return to low. Thus the trigger pulse to the one-shot is removed, allowing its output to return to low after a predetermined time delay set by VOX delay potentiometer RV3. PTT switch Q3 returns to the open state when the one-shot "times out," putting the transceiver back into the receive mode. If the operator pauses during his transmission and begins to speak before the one-shot "times out," the new positive trigger pulse from comparator U2C resets or re-triggers the one-shot circuit before it releases PTT switch Q3. The transceiver will drop out of

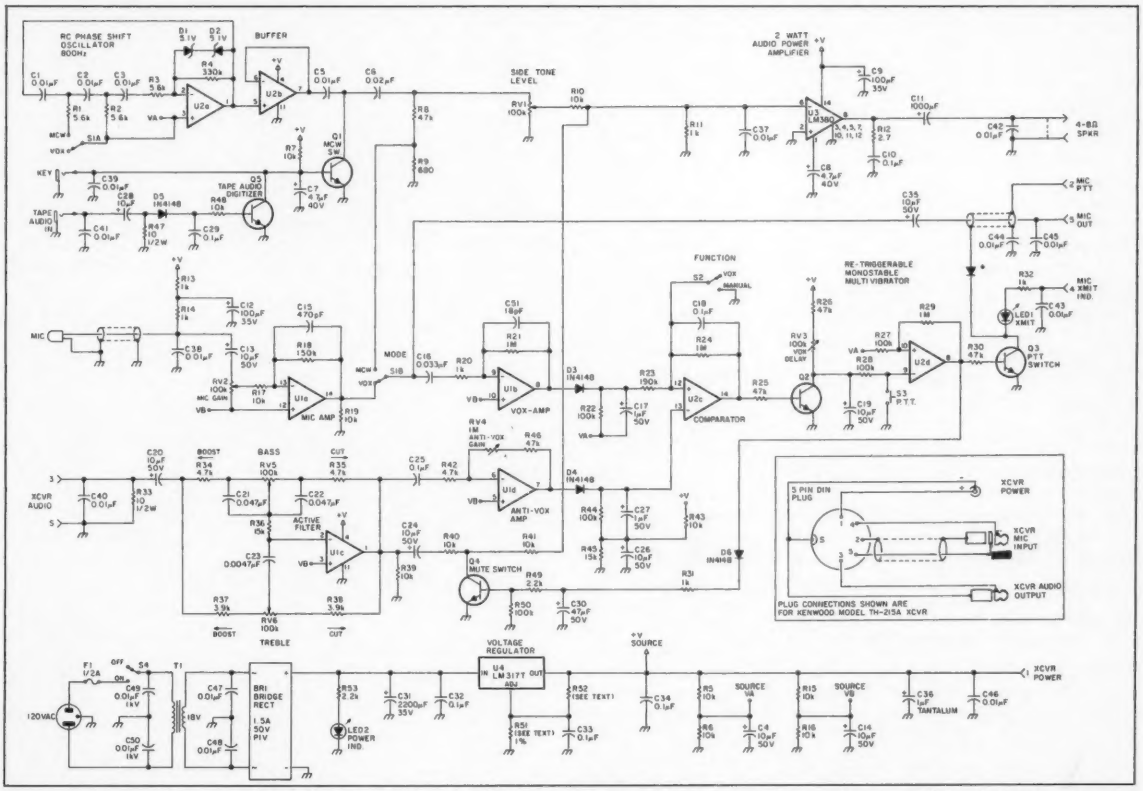

*Figure 3. Schematic diagram of the VOX Plus. (*To use the VOX Plus with other HTs, wire pin 2 for PTT when grounded and pin 5 for MIC audio out. For proper operation of the XMIT Indicator LED, attach pin 4 to +V and add a blocking diode in the PTT line as shown.)*

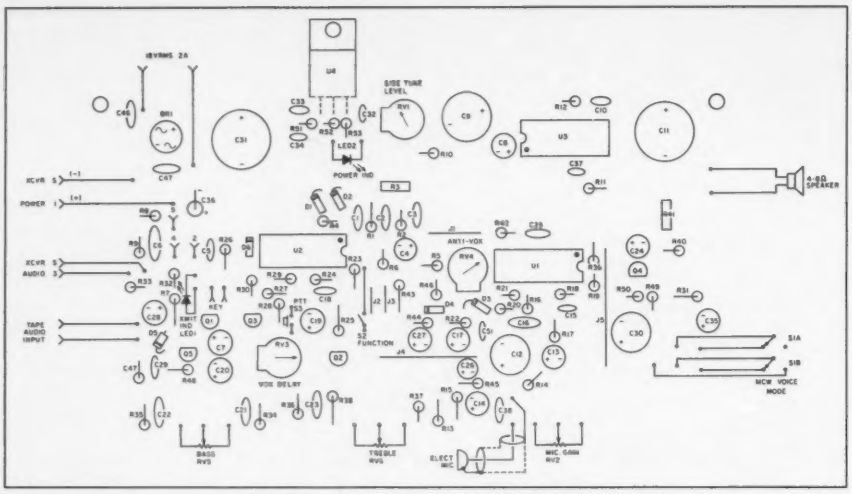

Figure 4. Parts placement for the VOX Plus.

transmit mode between words if the VOX delay is set too short.

Receive Mode

When the operator is not talking and an incoming signal is received, the audio signal from the transceiver is conditioned by active filter U1C, then passed to a 2 watt audio power amplifier capable of driving a 4- to 8-ohm speaker at a respectable level.

A sample of the transceiver's audio taken from the active filter output is used to cancel the effect of the audio picked up by the VOX Plus' electret microphone; this prevents the received signal from keying the transceiver. The transceiver's audio sample is taken from active filter U1C and amplified by anti-VOX amp U1D. Diode D4 rectifies the audio sample.

The positive peaks of the rectified audio charge capacitor C27, which is connected to the negative input of comparator U2C. The +0.6V DC bias level normally present on the negative input of U2C increases in direct proportion to the transceiver's audio. The anti-VOX gain, controlled by potentiometer RV4, is adjusted so that the bias level increase on the negative input of comparator U2C equals the bias level increase on the positive input.

The net result is that comparator U2C remains in its idle or low state because the negative input tracks the positive input bias level, and remains lower in level. The operator can still initiate a transmission by beginning to speak while an incoming signal is being received. The voice will cause an additional increase in the bias level only on the positive input of comparator U2C.

When the increase on the positive input of U2C exceeds the negative input, the VOX Plus will key the transceiver and operate as described previously. Resistor R44 is used to discharge capacitor C27 when transceiver audio ceases, returning the bias level on the negative input of comparator U2C to its normal value of +0.6V.

MCW Mode

MCW operation is selected by placing switch S1 in the MCW position. This starts the 800 Hz sine wave oscillator, U2A, which applies a sample of its output to the transceiver's microphone input and disconnects the internal electret microphone. Break-in MCW operation is identical to VOX operation, except the 800 Hz sine wave signal takes the place of the operator's voice. The presence of the 800 Hz audio signal at the input to the VOX amp is controlled by MCW mute, Q1. A key or keyer activates MCW mute Q1 and allows the 800 Hz signal to reach the VOX amp. The same process takes place as described for VOX operation, using the MCW signal instead of the operator's voice.

A second method of controlling MCW mute Q1 is to use an audio tape player. Code practice, CQ, or CW message is recorded on audio tape. When played back into digitizer Q5, on/off keying pulses are generated, which control MCW mute Q1. Note that since the tape audio only generates on/off keying pulses, no tape hiss, hum, or background noise is heard. Taped code is QRM-free

Table 1. Power Supply Voltage Programming Resistor Values

R51 (1%)	R52 (1%)	Output Voltage	NiCd Cells
4.7k	510	12.8V	10
3.9k	510	10.8V	9
2.2k	330	9.6V	8
2.7k	470	8.4V	7
3.9k	820	7.2V	6

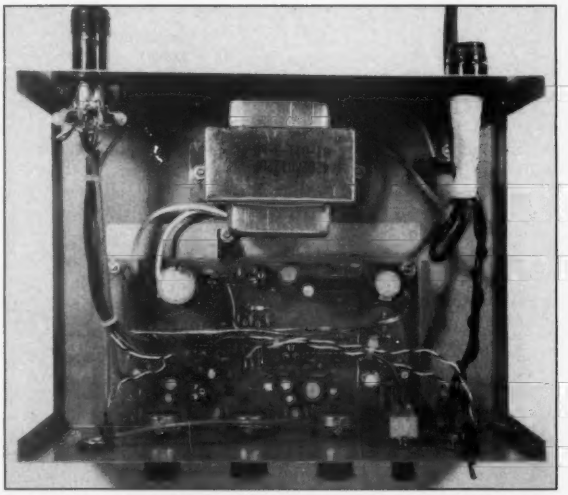

Photo B. An internal view of the VOX Plus. (Photo by Eric Wagner.)

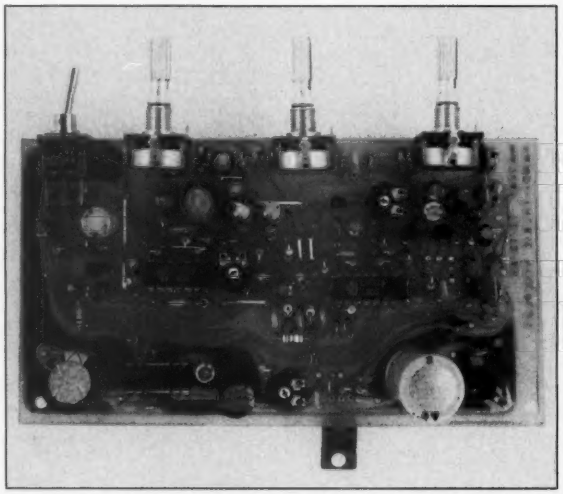

Photo C. Close-up view of the completed circuit board. (Photo by Eric Wagner.)

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Now...nothing excluded in the 806-912 MHz. band.
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10 Meter Mobile Transceiver • Digital VFO Full Band Coverage • All-Mode Operation Backlit liquid crystal display • Auto Squelch RIT • 10 Programmable Memory Positions
Frequency Coverage: 28.0000 MHz. to 29.6999 MHz.
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Table 2. Handi-Talkie VOX Plus

Resistors			
All resistors are ¼W, 5%, unless otherwise noted.			
R12	2.7	ohms	
R33,47	10	ohms	½W
R52*	510	ohms	1%
R9	680	ohms	
R11,13,14,20,31,32	1k	ohms	
R49,53	2.2k	ohms	
R37,38	3.9k	ohms	
R34,35,42	4.7k	ohms	
R51*	4.7k	ohms	1%
R1,2,3	5.6k	ohms	
R5,6,7,10,15,16,17,19, 39,40,41,43,48	10k	ohms	
R36,45	15k	ohms	
R8,25,26,30,46	47k	ohms	
R22,27,28,44,50	100k	ohms	
R18	150k	ohms	
R23	190k	ohms	
R4	330k	ohms	
R21,24,29	1	megohm	
RV1,3	100k	ohms	1 turn trimmer
RV4	1	megohm	1 turn trimmer
RV2,5,6	100k	ohms	linear taper pot
Capacitors			
C51	18	pF, 25V	ceramic disc
C15	470	pF, 25V	ceramic disc
C1,2,3	0.01	µF, 50V	ceramic disc, (NPO) or Mylar
C5,11,38,39,40,41,42, 43,44,45,46,47,48	0.01	µF, 50V	ceramic disc
C49,50	0.01	µF, 1 kV	ceramic disc
C6	0.02	µF, 25V	ceramic disc
C10,18,25,29,32,33,34	0.1	µF, 25V	ceramic disc
C16	0.033	µF, 25V	ceramic disc
C21,22	0.047	µF, 25V	ceramic disc
C23	0.0047	µF, 25V	ceramic disc
C17,27	1	µF, 25V	electrolytic
C36	1	µF, 25V	tantalum
C7,8	4.7	µF, 25V	electrolytic
C4,13,14,19,20,24,26, 28,35	10	µF, 25V	electrolytic
C30	47	µF, 25V	electrolytic
C9,12	100	µF, 25V	electrolytic
C11	1000	µF, 25V	electrolytic
C31	2200	µF 35V	electrolytic
Semiconductors			
BR1	50V, 1.5A		bridge rectifier
LED1,2	T1 style		red
D1,2	1N5231B, 5.1V DC		¼W zener diode
D3,4,5,6	1N4148		switching diode
Q1,2,3,4,5	2N3904		NPN, transistor
IC1,2	LM324		quad op amp
IC3	LM380		2.5W audio amp
IC4	LM317		adjustable voltage regulator
Other Components			
T1	18V, 2A		power transformer
S1	DPDT toggle switch		
S2,4	SPST toggle switch		
S3	normally open		push button
J1,2	mini-audio		jack
J3	5-pin DIN		jack
J4	RCA phono		jack
F1	½A fuse		with holder
Electret condenser microphone			
PC board			
AC power cord			
heat sink			
enclosure			
knobs			

5-pin DIN plug, mini-audio plugs (2), coaxial power plug.

*See Table 1. for R51 & R52 values.

Parts kits are availalble from Micro Mart, 508 Central Ave., Westfield NJ 07090. Tel. (201) 654–6008. PC board and components are $29.95, plus $2.50 S&H; the parts kit, less enclosure, heat sink, and knobs, is $49.75, plus $3.75 S&H; the PC board only is $12.95, plus $2.50 S&H; and the power transformer is $4.75 plus $3.50 S&H.

and indistinguishable from hand-sent code.

Other Features

FUNCTION switch S2 disables comparator U2C so you can operate in manual mode. In this mode, you must use PTT switch S3 to key the transceiver. This feature is useful in voice mode when the room noise level causes false XCVR keying, or in the MCW mode to use the VOX Plus' sidetone as a code practice oscillator. A programmable regulated power supply is available for powering transceivers that operate from six to ten 500 mAh NiCd batteries. The output voltage is programmable by changing the value of resistors R51 and R52. See Table 1 for programming resistor values.

Design Details

A few words need to be said regarding some of the "basic" op amp circuits, since their physical implementation is slightly different from the theoretical description. The design of the RC phase-shift oscillator requires some practical modification to attain dependable operation.

In theory, the circuit will oscillate when the gain is set to a value of 1/29. This is a very critical value. If the value is slightly less, the circuit will not oscillate. If the value is slightly more, the output waveform will clip, resulting in distortion. This problem is overcome by adding amplitude compensation to the circuit.

Back-to-back zener diodes are placed in parallel with feedback resistor R4. The zener diodes decrease the gain of the oscillator as the output amplitude approaches the positive power supply rail to prevent it from clipping and distorting the waveform. Because of the zener diodes, you need more gain to get the oscillator started, thus the gain is higher than 1/29.

In theory, the frequency of oscillation of the RC phase-shift oscillator is given as: $f = 0.065/RC$. The addition of amplitude compensation using the zener diodes causes the actual frequency to be lower. It is difficult to predict the actual frequency of oscillation because zener diodes are nonlinear devices, and therefore, linear analysis can not be used to determine it. The theoretical equation does, however, give a good place to start.

A practical note pertains to the use of the LM324 op amp. For capacitively coupled loads, a resistor should be used from the output to ground to increase the class A bias current and prevent crossover distortion (see the National Semiconductor Corp.'s *Linear DataBook 1* 1988). This is the purpose of resistors R19 and R39. Notable distortion was present without them.

The one-shot circuit consists of transistor switch Q2 and comparator U2D. The trigger pulse is applied to the base of Q2 via R25, which limits the base current to a safe value. Each time a positive trigger pulse is applied to R25, Q2 discharges capacitor C19 to ground. The voltage across C19 is applied to the negative input of comparator U2D; the positive input of U2D is fixed at V/2. When C19 is discharged to ground, the voltage across C19

falls below V/2 and the output of comparator U2D goes high.

The output remains high until the voltage across C19 rises above V/2 volts. The charge time of C19 is controlled by the series combination of resistors R26 and RV3, VOX delay. The circuit is re-triggerable because capacitor C19 can be discharged repeatedly by a trigger pulse, effectively resetting its charge time. MUTE switch Q4 is activated by the output of the one-shot by charging capacitor C30 via diode D6 and resistor R31.

The voltage across C30 supplies base current to Q4 via base resistor R49. Q4 turns on and bypasses to ground the audio present at the junction of the voltage divider that consists of R40 and R41, preventing it from reaching the audio power amp U3.

Capacitor C24 provides DC isolation. When the one-shot times out, diode D6 prevents C30 from discharging immediately. MUTE switch Q4 remains on while C30 discharges through resistors R49 and R50, and keeps the audio path shunted to ground. In this way, the attack and decay of the MUTE switch are controlled, and the introduction of noise by the action of the mute circuit itself is prevented.

Construction

Only common components are used in this project. Most of them can be found in your junk box. If you don't have a junk box, you can get all the parts from *Micro Mart* (see parts list).

Due to the number of components, I chose PC board construction. You could also use point-to-point wiring. Photo B. shows the circuit board mounted in a Radio Shack steel enclosure. Note that voltage regulator U4 is mounted on the copper side of the board, keeping the leads as short as possible to minimize RF pickup and to maintain load regulation. This also simplifies access to the aluminum heat sink mounted to the bottom of the steel enclosure. The steel enclosure does not make a suitable heat sink because of its lower thermal conductivity. The dimensions of the aluminum heat sink are 6" x 2.5" x 0.0625".

Connect the transceiver's power, microphone, and speaker jacks with a 5-pin DIN plug, its receptacle mounted on the rear panel. Bypass capacitors C40, C43, C44, C45 and C48 are mounted at the 5-pin DIN receptacle to prevent RF from disrupting circuit operation. Access to the KEY input and TAPE AUDIO input are made with 3.5mm phone jacks. An RCA audio jack is used for the speaker output. Bypass capacitors C39, C41, and C42 associated with these terminals are also located on their respective jacks.

Setup and Operation

Check the circuit carefully before applying power. If all looks good, set the FUNCTION switch S2 to manual and set the MODE switch S1 to the MCW position. Set BASS and TREBLE to center position, and MIC GAIN control to minimum. Set sidetone level control RV1 to minimum by turning it CCW; then turn it ⅛ turn CW. Set VOX delay RV3 and anti-VOX gain RV4 to center position. Connect a 4- to 8-ohm speaker to the speaker jack and a telegraph key to the KEY input.

Before connecting the VOX Plus to your transceiver, turn on POWER switch S4 and check the programmed power supply voltage to ensure its value is correct, as selected from Table 1. The supply voltage should be within 5% of the selected value. Press the telegraph key and listen for the 800 Hz sidetone from the external speaker. Adjust sidetone level RV1 to the desired level.

Connect the transceiver to the VOX Plus. Be sure to use an external antenna to prevent strong RF fields from causing undesirable operation. Tune in a QSO and try varying the BASS and TREBLE controls. You should be able to make muffled signals or tinny signals more natural sounding, and attain better readability.

To operate break-in MCW, change FUNCTION switch S2 to the VOX position and start sending. The VOX Plus will automatically key the transmitter when you start sending code. The transceiver should remain in the transmit mode until about 1 second after you stop sending. If the transmitter drops out between letters or words, increase VOX delay RV3 by turning it CW.

To operate voice, change MODE switch S1 to the voice position, turn the MIC GAIN control to about ¾, and talk only when you what to transmit. Remember, you are now operating VOX, and you should turn the microphone gain down when you're not in a QSO.

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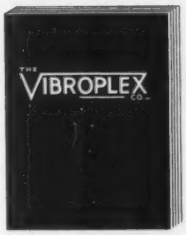

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73 Review

by Bill Brown WB8ELK

The Lightning Bolt Dual-Band VHF/UHF Quad

Two antennas in one compact package.

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Phone: (412) 530–7396
Price Class: $50 (2-element 2m, 4-element 70cm); $80 (4-element 2m, 8-element 70cm).

Whether heading out for a mountaintop, foxhunting or setting up a portable station at a moment's notice, it's best to lug as little equipment along with you as it takes to do the job. For dual-band operation, the biggest hassle is carrying two antennas, along with the associated masts and mounts. All this adds up to additional weight and increased set-up time.

Mike Duddy of Lightning Bolt Antenna has the answer. He has come up with a dual-band 2m/70cm quad that is both lightweight and easily assembled in the field.

The dual-bander provides you with a 2-element quad on 2 meters and 4 elements on 70cm using just eight Fiberglas™ rods arranged to provide four crossed mounts. A larger version is available with 4 elements on 2m and 8 elements on the 450 MHz band.

Easy to Carry and Assemble

I had a chance to test out the dual-bander during a recent expedition out to Monhegan Island, Maine (see front cover). The only way out to this remote island is to take a 10-mile ferry boat ride. Nuge WB8GLQ and I were hoping to operate packet with the space shuttle SAREX mission (unfortunately scrubbed) from the vantage point of the lighthouse on top of the island. In addition, we planned to make a few ATV contacts on 70cm using 2 meters for our talk frequency.

The dual-band quad comes packaged in a heavy-duty 3-foot-long mailing tube. Everything fits nicely inside, providing an excellent way to transport the quad. After packing our station up into two bags we hopped onto the boat to Monhegan. Once on the island, it was an easy hike up the steep trail to the lighthouse with our lightweight packet and ATV station.

The only tools needed to assemble the quad are a small screwdriver and a crescent wrench to tighten the U-bolt clamp to the support mast. The spreader arms are constructed out of ½" Fiberglas™ rods which have grooves for holding the quad loops. Each rod has a threaded hole to accept the mounting screw. The spreaders are pushed through holes in a 2-foot-long square boom. Each spreader is lettered and matches the letter on the boom. The spreaders can be quickly attached to the boom with the mounting screws. The wire loops are held in place by grooves in the ends of the spreaders. The four large spreader arms support the 2 meter quad loops along the ends, as well as supporting the reflector and the last director of the 70cm loops via grooves cut into the middle of the supports.

I found that the best method was to install the loops as I assembled each set of spreader arms. Once complete, all I needed to do was to mount the antenna to my mast with the U-bolt (included with the antenna). This version has holes drilled in the boom to allow end-mounting to the mast. Total assembly time was about 10 minutes.

Photo A. Evan Cooke (l) and Nuge WB8GLQ (r) use the Lightning Bolt quad to make contact on ATV and 2 meters.

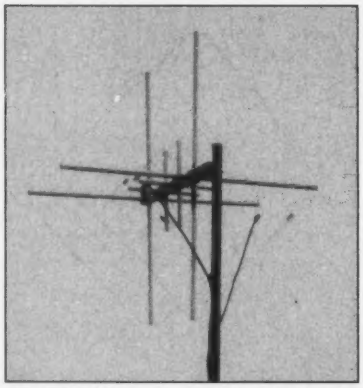

Photo B. Close-up view of the dual-bander quad.

The driven elements both have female BNC connectors attached. I found that the quad loops seemed somewhat loose in their grooves. However, this provided an easy way to change polarization quickly just by sliding the wire in the grooves. For a more permanent installation, you might secure the loops with a dab of epoxy. Lightning Bolt can also provide you with drilled holes instead of grooves for permanent mounting of the loops. Also, I found that the Fiberglas boom seemed a little rough in appearance. It may be a good idea to sand it down some to avoid the "itchy finger" syndrome.

Our total station consisted of a Radio Shack Model 100 laptop computer, a Heath pocket TNC, a Kodak Diconix™ printer, an ICOM 2m HT, a 1-watt P.C. Electronics ATV transmitter, a GBC CCD-100 miniature TV camera, a Radio Shack pocket-sized color LCD TV receiver and, of course, the Lightning Bolt dual-band quad.

Island-Topping with the Lightning Bolt

Although the space shuttle launch was scrubbed, we did make a number of packet contacts up and down the coast of Maine. Also, we made a very successful contact with Jon WA2YVL in Freeport, Maine, on 2m and ATV. The gain is about what you'd expect from a 2-element quad on 2 meters: about 6 to 7 dBd. On the 440 MHz band we saw about 9 dBd gain. This certainly made the difference, since the quad brought Jon's signal from two lights on my HT to a full-scale reception. On 439.25 MHz ATV the 4-element quad made the difference between a 50% snowy picture (using a ¼-wave whip) to a full-color, nearly closed circuit image (using the 4-element quad). We observed about a 3 dB improvement over my home-brew 6 dBd 2-element quad. The front-to-back ratio seemed excellent, and we saw a nice clean pattern as we rotated the antenna.

After a fine afternoon island-topping, we quickly disassembled the quad and headed down the hill for our return boat.

We found the Lightning Bolt dual-band quad to be a great choice for portable operation, and to be sturdy enough to survive a good deal of abuse! 73

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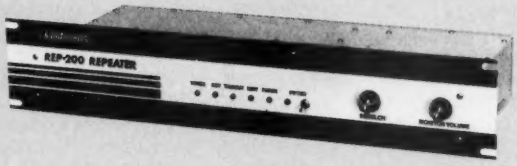

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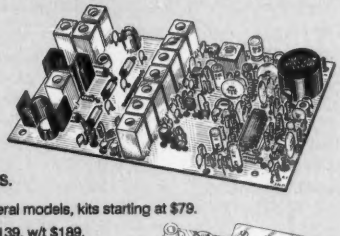

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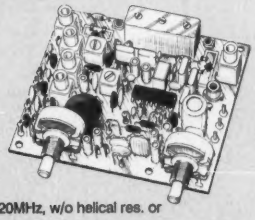

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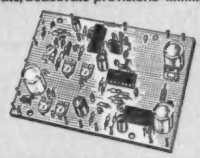
- **R451 UHF FM RCVR,** similar to above
- **R901 902-928MHz FM RCVR.** Triple-conversion, GaAs FET front end.
- **R76 ECONOMY FM RCVR** for 6M, 2M, 220MHz, w/o helical res. or afc. Kits $129.
- **R137 WEATHER SATELLITE RCVR** for 137 MHz. Kit $129, w/t $189.

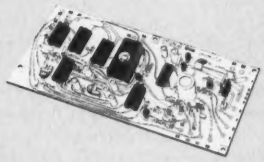
ACCESSORIES

TD-3 SUBAUDIBLE TONE DECODER/ENCODER kit. Adjustable for any tone. Designed **especially for repeaters,** with remote control activate/deactivate provisions $24

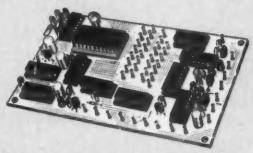


COR-3 REPEATER CONTROLLER kit. Features adjustable tail & time-out timers, solid-state relay, courtesy beep, and local speaker amplifier $49

CWID kit. Diode programmed any time in the field, adjustable tone, speed, and timer, to go with COR-3 .....$59



COR-4 kit. Complete COR and CWID all on one board for easy construction. CMOS logic for low power consumption. Many new features. EPROM programmed; specify call $99



TD-2 TOUCH-TONE DECODER/CONTROLLER kit. Full 16 digits, with toll-call restrictor, programmable. Can turn 5 functions on/off. Great for selective calling, too! $79

AP-3 AUTOPATCH kit. Use with above for repeater autopatch. Reverse patch & phone line remote control are std .$79

AP-2 SIMPLEX AUTOPATCH Timing Board kit. Use with above for simplex operation using a transceiver $39

MO-202 FSK DATA MODULATOR kit. Run up to 1200 baud digital signals through any fm transmitter with full handshakes. Radio link computers, telemetry gear, etc. $39

DE-202 FSK DEMODULATOR kit. For receive end of link. $39

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at a fraction of the cost of comparable units!

LNG-(*)

***ONLY* $59** wired/tested

FEATURES:

- **Very low noise:** 0.7dB vhf, 0.8dB uhf
- **High gain:** 13-20dB, depends on freq
- **Wide dynamic range** - resist overload
- **Stable:** low-feedback dual-gate FET

**Specify tuning range: 26-30, 46-56, 137-150, 150-172, 210-230, 400-470, or 800-960 MHz.*

LNW-(*) MINIATURE GaAs FET PREAMP

***ONLY* $24**/kit, **$39** wired/tested

- GaAs FET Preamp similar to LNG, except designed for **low cost & small size.** Only 5/8"W x 1-5/8"L x 3/4"H. Easily mounts in many radios.

**Specify tuning range: 25-35, 35-55, 55-90, 90-120, 120-150, 150-200, 200-270, or 400-500 MHz.*

LNS-(*) IN-LINE PREAMP

***ONLY* $79**/kit, **$99** wired/tested

- GaAs FET Preamp with features similar to LNG **series,** except **automatically switches out of line during transmit.** Use with base or mobile transceivers up to 25W. Tower mounting brackets incl.

**Specify tuning range: 120-175, 200-240, or 400-500 MHz.*

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**Specify tuning range: 142-150, 150-162, 162-174, 213-233, 420-450, 450-470.*

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Request catalog for complete listings.

VHF input ranges avail: 136-138, 144-148, 145-147, 146-148; kit less case $39, kit w/case $59, w/t in case $89.

UHF input ranges avail: 432-434, 435-437, 435.5-437.5; kit less case $49, kit w/case $69, w/t in case $99.

TRANSMITTING CONVERTERS

XV2 for vhf and XV4 for uhf. Models to convert 10M ssb, cw, fm, etc. to 2M, 432, 435, and for atv. 1W output. **Kit only $79.** PA's up to 45W available. *Request catalog for complete listings.*

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CIRCLE 57 ON READER SERVICE CARD

73 Review

by Dick Goodman WA3USG

The PacComm PSK-1

Connect to the world via the Microsats!

PacComm
3652 West Cypress Street
Tampa FL 33607
(813) 874–2980, (800) 223–3511
Price Class: $250 (Includes power supply, manual, and TNC/radio/telemetry.)

Orbiting the Earth at an altitude of approximately 800 kilometers are four satellites which may be accessed and communicated through via packet radio. These birds have something in common that is not shared by the other active ham satellites: They must be accessed using PSK (Phase Shift Keyed) modulation, rather than with conventional AFSK (Audio Frequency Shift Keying), which is the present terrestrial packet standard. These satellites are also known as "Microsats" because of their small size.

•OSCAR 16 (PACSAT): Built by AMSAT NA. Can presently be used as a digipeater. Uplink frequencies are in the 2 meter band, using conventional FM transceivers; downlink is in the 70cm band, using SSB reception. In the near future it will support a store-and-forward mailbox.

•OSCAR 18 (WEBERSAT): Built by Weber State University in Utah. Contains an onboard CCD camera that downlinks its pictures via packet radio. Also contains an ATV experiment which will be activated in the future.

•OSCAR 19 (LUSAT): Built by AMSAT Argentina. Same characteristics as OSCAR 16.

•OSCAR 20 (FUJI-2): Built by AMSAT Japan. Packet store-and-forward mailbox. Uplink 2 meter FM; downlink on 70cm, using SSB reception.

Why Use PSK?

Current packet radio TNCs come with an AFSK modem installed. These are fine for terrestrial packet communication over high quality VHF links, but fail miserably when subjected to poor signal-to-noise ratios or frequency shift due to the Doppler effect. Existing AFSK packet modems must be maintained to within approximately ±50 Hz of the center frequency. Since the Microsats are in low Earth orbit, their velocity in relation to the user is great. This equates to a very large Doppler shift when the satellite is at its closest approach. This shift is so great that a signal tuned in will drift completely out of the receiver bandpass in a matter of minutes. Existing AFSK modems would be virtually impossible to keep tuned during these conditions.

The signals from these OSCARs are also taking fades from spin modulation and are sometimes weak. This is due to the nature of the low gain antennas used on the satellites, and to the orientation of both satellite and ground station antennas (eg: cross polarization).

Finally, the present AFSK standard was actually developed in the 1970s for use in computer telephone modems. It was put to use in TNCs because it was cheap and available, but it's certainly not state-of-the-art! What is needed for satellite work (especially low orbit satellites) is a modem that will perform well in the environment identified above.

The Answer

The PacComm PSK-1 satellite modem fills this requirement nicely. It is a small package, approximately 1½" high, 6" wide and 9" deep. It requires 12 VDC and comes supplied with a small plug-in power supply. The PSK-1 will do the following:

1. Lock on and copy signals that are off frequency by as much as ±400 Hz.
2. Automatically tune the receiver to maintain proper center frequency.
3. Give excellent performance during poor signal-to-noise conditions.
4. Allow you to still use the AFSK modem in your TNC for conventional terrestrial packet operation.
5. Copy the telemetry data from Phase 3 satellites (OSCAR 10 and 13) from their engineering beacons.

Interconnections to Your Equipment

PSK-1 to your VHF FM radio: The cable provided by PacComm has a 5-pin DIN plug for PSK-1 connection on one end; the other end has stripped and tinned leads for attachment to your radio. Note that this is the same pinout configuration for the TAPR PSK Modem.

PSK-1 to your UHF radio: The cable provided by PacComm has a 5-pin DIN plug for PSK-1 connection on one end; the other end has stripped and tinned leads for attachment to your radio. Note that this is **NOT** the same pinout configuration as the TAPR PSK Modem. This connection **MUST** be made if you want the PSK-1 to automatically compensate for Doppler.

PSK-1 to your TNC's "Radio" connector: The cable provided by PacComm has a 5-pin DIN plug for PSK-1 connection on one end; the other end has stripped and tinned leads for connection to your TNC's "Radio" port. (Note: Your VHF FM radio is no longer connected directly to your TNC, but is routed through the PSK-1 modem. This configuration will allow you to switch to either the TNC's AFSK modem for conventional packet operation, or to the PSK-1 for satellite work.)

PSK-1 to your TNC's modem disconnect header: The cable provided by PacComm has an 8-pin DIN plug for PSK-1 connection on one end; the other end has stripped and tinned leads for attachment to your TNC's modem disconnect header. Also provided is the 20-pin plug to attach to any TAPR TNC-1 or TNC-2 clone inline header. The stripped and tinned leads attach to this and it simply plugs into the TNC's modem disconnect. (Note: The operating manual included with the PSK-1 goes into considerable detail. It took me 15–20 minutes to wire the header plug. If you are presently using a TAPR PSK modem, your existing cable will work fine!)

PSK-1 to your computer's serial port (RS-232 & TTL both supported): Please note that actual packet data is still routed via serial cable going to your TNC. The connection identified here allows control of many PSK-1 parameters from your computer. This is also the port where Phase 3 telemetry data is routed (since it is simply ASCII data and not formatted into AX.25 packets).

Once the PSK-1 is correctly interfaced to your computer, TNC, and Radio(s) the fun begins. When power is applied to the PSK-1 the

Photo A. The PacComm PSK-1.

front panel LEDS cycle through a short self-test procedure and the modem is ready for use. The front panel of the PSK-1 is logically laid out with 9-status LEDs (which also function as a bar graph tuning indicator), two up/down tuning LEDS, a PLL "LOCK" LED, and two switches which can control set up of the PSK-1.

Operating the PSK-1

The PSK-1 may be set up by two methods. The first is with the FUNCTION and SELECT push buttons on the front panel. The FUNCTION switch cycles through each of the four PSK-1 functions. The SELECT switch allows each of these functions to be configured independently. For example, press the FUNCTION switch until the MODE function status LED is lit (each press of the push button cycles through one of the four functions). Now, by pressing the SELECT switch you can configure the mode function for Manchester PSK for satellite operation, terrestrial PSK, or 400 baud Phase 3 telemetry gathering. Press the FUNCTION switch again and the MODEM function LED will light. By pressing the SELECT switch, the entire PSK-1 unit can be toggled in or out, thus allowing easy access to your TNC's internal AFSK modem. Pressing the FUNCTION switch again will illuminate the JT/SP function LED. Depressing the SELECT switch here selects which radio(s) will be used with the PSK-1. In the JOINT position, all PSK-1 data (both TX & RX) will be routed from the VHF port on the PSK-1. In the SPLIT position, TX data will be routed from the VHF port of the PSK-1 to the VHF radio and RX data from the UHF radio to the UHF port on the PSK-1. Pressing the FUNCTION switch again lights the AFC function LED. The SELECT switch now controls how the PSK-1 tunes the UHF receiver to compensate for Doppler.

The other method of setup is by computer control. The serial port of your computer must be connected to the PSK-1 SERIAL PORT (not the TNC serial port). I recommend using an A-B switch on your computer's serial port to accomplish this (A to your TNC, B to the PSK-1 serial port). The same terminal program that you use for your TNC will work fine for controlling the PSK-1. The default baud rate of the PSK-1 serial port is 1200 baud, no parity, 8 bit word length, 1 stop bit (1200,N,8,1), so initially set your terminal program to those parameters. You can change the PSK-1 serial port baud rate to match your computer to TNC baud rate later. Powering up the PSK-1 will present an entire series of menus which will allow setup of all previously specified parameters, plus options not available from the front panel switches.

Either method of setup is detailed adequately in the PSK-1 user manual. I would strongly suggest reading it from cover to cover before using the modem.

Using the PSK-1 on the Birds

Tune in the signal from one of the four Microsats on your UHF receiver in the SSB mode. Also, ensure that your TNC is in the MONITOR mode and MALL is on. I found the LOCK LED on the PSK-1 to be a bit over-sensitive, and it will flicker on random receiver noise. But, when the satellite is tuned anywhere close to being on frequency, the LOCK LED will illuminate constantly, and the front panel status LEDs will function as a bar graph tuning indicator. If you have the automatic Doppler shift compensation feature active, the PSK-1 will finish tuning itself in and you will not have to touch the receiver while tuning for the duration of the pass! To use the AUTO TUNE feature, you must be using a UHF radio that has mike click up/down tuning capability. If you are tuning the receiver manually, use the CENTER TUNE feature on the bar graph. You should now see data from the Bird scrolling down your screen.

I have used the PSK-1 with a TS-711/811 combination in the automatic Doppler mode and it works quite well. My home station uses a Hamtronics UHF receive converter driving a Kenwood R-2000 HF receiver. I have to tune the receiver manually, but the PSK-1 maintains lock on the signal to about 500 Hz off frequency.

To transmit, dial in the correct uplink frequency on your VHF radio and issue the appropriate connect request with your TNC. Since the satellites have automatic Doppler compensation on the uplink, you don't have to worry about keeping the VHF radio on frequency. Ensure that you don't over-drive the VHF transmitter because PSK is a linear mode. There is an external adjustment for the modem's audio output on the rear panel of the PSK-1.

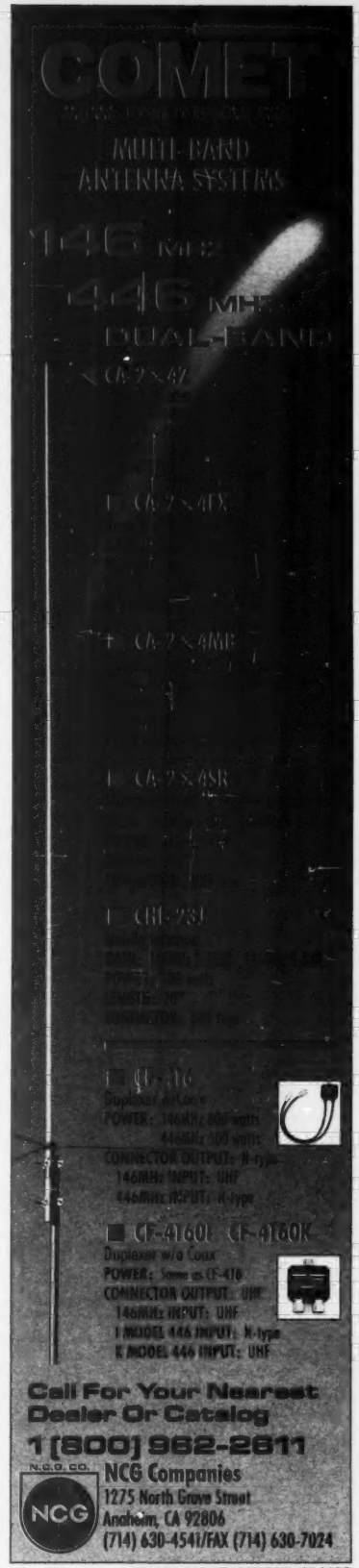
Some Final Thoughts

The PacComm PSK-1 is an excellent piece of equipment that should appeal to anyone interested in using packet communication through any satellite. Since PSK is more impervious to weak signal and fading conditions than AFSK, it works quite well on the Phase 3 birds, and is superior for terrestrial packet under QRM and QSB conditions.

The PSK-1 will interface to many TNCs. The operating manual details the following interface requirements: TAPR TNC 1 and 2 Clones (TNC 1 will not work on OSCAR 20), PacComm Tiny-2 (what I am using), MFJ-1270, MFJ-1274, MFJ-1278, AEA PK-232 (read the manual carefully), AEA PK-88, AEA PK-87, Kantronics KAM, KPC-4 (KPC-1 & KPC-2 will not work with PSK-1).

I was amazed at how well the PSK-1 copied signals under conditions where an AFSK modem would totally fail. Tuning is not at all critical—get within 400–500 Hz on **EITHER SIDE OF CENTER** and the data starts scrolling by! Once you've read the operating manual, mode changes and operation are intuitive. The ability to do rapid mode/function changes from the front panel, or more detailed configuration changes via computer control, is a real plus. Finally, the fact that the PSK-1 will decode Phase 3 telemetry blocks adds the capability that would normally require an additional dedicated $100 modem. A program to convert these blocks to intelligent parameters is still required and available from AMSAT.

I hope to see you on the birds! 73



CIRCLE 54 ON READER SERVICE CARD

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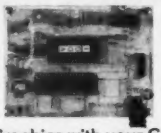

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CIRCLE 96 ON READER SERVICE CARD

Pack Your Seabag, "Sparks"

Do you want to be a ship's Radio Officer?

by Michael A. Davidson NØMM

Lisbon, Naples, Palermo, Alexandria, Karachi, Singapore, CUL, IAR, SUH, ASK, 9VG: Ports visited and coastal stations worked by "Sparks," a Merchant Marine radio officer, on a typical voyage. Is this something you always thought you'd like to do? Pack your seabag and come aboard!

Pretend that two days ago you received a call: "She's a freighter going to the Med and Singapore. Do you want the job?" Sure you do!

It's been a busy day. The plane trip, coming aboard, signing on. Now it's quiet. Here you are, on your first "solo" job as a ship's radio officer. You go over the radio room equipment with the vacation-bound radio officer. You've said your goodbyes, and the ship is your home for the next three months. The radio equipment looks familiar. The console with the R/T MF and HF transmitters and receivers, the SSB and linear amp, the SITOR and SATCOM consoles over in the corner, don't look too different from the gear you became familiar with last year, while sailing as assistant radio officer.

The Merchant Marine

What is the Merchant Marine and how do you become a ship's radio officer? When people ask me what I do for a living, and I tell them I sail in the Merchant Marine, they often respond, "Oh, yes, my son [brother, etc.] is in the Marines!"

In the Merchant Marine, you're a civilian. The only direct military connection is with the U.S. Coast Guard Marine Inspection and Safety Division. In addition to their governmental duties, they set training and experience levels, conduct examinations for deck and engineering personnel, and issue Merchant Marine seaman's papers. In time of war, the Merchant Marine would come under naval command and protection. For more information, call the U.S.C.G. at (314) 425-4655.

The vessels of the Merchant Marine fleet are owned by companies whose business is maritime cargo transportation. Some specialized vessels are oil tankers, chemical and liquid gas carriers, bulk carriers, car carriers, and container ships or freighters. Merchant Marine ships carry almost anything that's impractical to transport by air due to weight, bulk, or quantity. The ships range in size from small coastal vessels with only a few crew members, to ULCCs (Ultra Large Crude Carriers) that measure up to 1,500 feet from stem to stern, with crews of 30 or more.

On board there are four departments: deck, engine, radio, and steward. The first officer (chief mate) supervises the deck; the chief engineer, the engine room; and the chief steward, the ship's galley and housekeeping. Each is responsible to the ship's master or captain.

But the radio department is unique. Unlike the other departments, it consists of only one person, the radio officer, who works directly under the captain's orders.

What Does an R.O. Do?

By international law, ships equipped with a radio telegraph station must carry a radio operator to stand watch on the calling and distress frequencies, 500 kHz (W/T) and 2182 kHz (R/T). There are some exemptions for coastal voyages, but generally the SOLAS (Safety of Life at Sea) regulation applies.

At sea, seven days a week "sparks" stands an eight-hour radio watch. The usual hours are from 0800 to 1200, 1500 to 1700, and 1800 to 2000. He monitors 500 kHz and 2182 kHz and logs all traffic sent and received, and silent periods observed. Sparks is also on-call 24 hours a day for emergency repairs to electronic equipment.

In addition to the radio officer's basic duties, he handles the transmission and reception of the ship's traffic. The traffic could be CW (W/T) on medium-wave frequency (450 to 535 kHz) or on the high frequency maritime bands (2 to 22 MHz) using either W/T or voice (R/T), radio telephone, or telex via SITOR on HF (basically the same as AMTOR). Using the satellite communications terminal, SATCOM, traffic is passed telex or voice mode via INMARSAT. Facsimile is being installed in more and more ships. This mode uses a voice channel on the SATCOM for transmit and receive, and it can also be used on HF channels.

Although W/T (Wireless Telegraphy) and R/T (Radio Telephony) are United Kingdom abbreviations, they are used in ITU publications and understood throughout the maritime radio world.

Arrival and departure times can be busy, with messages to the ship's owners, charterers, and agents; observer weather reports; private calls for the crew via the high seas operator on R/T and SATCOM; and reports to the U.S.C.G. Amver system. Amver is a maritime assistance program that provides search and rescue (SAR) efforts. Participation is mandatory for U.S. registered vessels and voluntary for "foreign flag" vessels on voyages over 24 hours long.

Photo A. Radio adventure on the high seas.

Weather reports at sea and FAX weather charts are copied daily by the radio officer. The weather reports are broadcast on CW, SITOR, and voice by the U.S.C.G., U.S.N., and commercial and national coastal stations around the world. And in the winter months, on-station North Atlantic weather ships known as OWSs (Ocean Weather Stations) transmit up-to-date forecasts and storm warnings. They also accept observer weather reports from ships passing through their areas.

Simple accounting for traffic charges is also part of the R.O.'s job. Traffic charges are based upon word count or duration of

the message or telex. Charges, if not known, are requested from the coast station worked, or if via satellite, from INMARSAT tariffs in the radio room. The R.O. is, in effect, an agent for the ship's radio accounting authority or company. It may sound complex and involved, but in practice it's quite simple. After completing your six months under the guidance of an experienced radio officer, you would be very familiar with these procedures.

On arrival in port, you are usually free to go ashore. Maybe even have an "eyeball QSO" with hams you worked off watch at sea. A visit with three JA's in Yokohama, one a Shinto priest, was the result of a QSO on a trip to the Far East. So if you don't have any repairs or inspections coming up in port, you can head down the gangway. But don't forget to check the Sailing Board; you must be aboard one hour before sailing time.

Becoming a Radio Officer

To be employed as a radio officer in the U.S. Merchant Marine, you must be a U.S. citizen and have the following licenses, endorsements, and documents:

1. **An FCC radiotelegraph license.** It must be at least a Second Class Radiotelegraph license with a Six Month Service Endorsement.

2. **A U.S. Merchant Marine Officer's license,** issued by the United States Coast Guard.

3. **A U.S. Merchant Mariner's Document (Z-Card),** issued by the United States Coast Guard.

In order to sail as the *sole* radio officer on a U.S. Merchant Marine ship, your radiotelegraph license must have a Six Month Service Endorsement. According to FCC Rules and Regulations, Part 83, in order to get the endorsement you must have "...at least six months satisfactory service as a qualified radiotelegraph operator in a station on board a ship or ships of the United States." Catch 22? Not really. If you have military or naval sea time experience with CW, as a radioman or radio operator, you could possibly get some credit for the service endorsement. Check with the FCC. Failing this, all is not lost. Later, I'll describe various methods to get that "sea time" and the endorsement. First, the license.

The Radiotelegraph License

As a prospective radio officer, your first step is to pass the FCC examination for the Second Class Radiotelegraph license (T-2). This two-part examination is held at FCC offices. The code test consists of transmitting and receiving plain language at 20 wpm and 16 code groups per minute. The written, multiple choice test consists of Elements 1, 2, 5, and 6. It's similar to the General Radiotelephone license examination, but emphasizes radiotelegraph practices and procedures, maritime equipment, and radio direction finding. The FCC examiner may require you to draw block diagrams or schematics. On my exam, I had to draw a block diagram and schematic of a direction finder. I'll never forget that the antenna has a "gap"!

An excellent license preparation manual, the *Marine Radiotelegraph Operator License Handbook,* by Edward M. Noll, is available from WPT Publications, 979 Young St., Suite A, Woodburn OR 97071. Tel. (503) 981-5159. If you would rather not tackle the theory and code in one sitting, you can take the examination for the Third Class Radiotelegraph Permit (T-3) and get the code requirement out of the way first. This examination consists of the code test already mentioned, plus Elements 1, 2, and 5, which cover basic law and operating practices.

Then you can then concentrate your studies on Element 6, electronic theory. And while you're in the study mode, don't forget the Ship Radar Encorsement, Element 8. This endorsement will allow you to service and maintain the shipboard radar system. You can take Element 8 separately or with Element 6.

Shipping Out

All that effort and study pays off. Let's say you have your Second Class Radiotelegraph license with the Ship Radar Endorsement. You can almost smell the sea air. But what about that Six Month Service Endorsement? If you have a letter from either a shipping company or a maritime union stating that you have been offered shipboard employment as an assistant radio officer or apprentice radio officer, the Coast Guard will issue you the U.S. Merchant Mariner's Document, or Z-Card, and the Merchant Marine Officer's License.

As suggested above, you can get the sea time for the endorsement through an independent shipping company. You would sign on as an ordinary seaman, engine room wiper, or galleyman. In your off-watch hours, you would stand watch in the radio room. You would have to keep a log for the FCC to evaluate, of the dates and hours you stood the radio watches, and have it signed by the radio officer and master, or captain. This can be a lengthy process, but it's a method that has been successfully used to obtain the endorsement.

Sailing on "foreign flag" ships as a radio operator is another way to obtain experience. This sea time would not be applicable toward the service requirement, but it could put you in a favorable position when applying to an independent company or to a union for an assistant radio operator position. Sailing foreign flag, you would not be required to have the U.S.C.G. license or the Z-Card. You'd only need the FCC Second Class Radiotelegraph license and the appropriate country's seaman's document.

In the past, ships of Panamanian and Liberian registry have been traditionally used by "unendorsed" radio officers seeking experience. But with the increase in countries that offer "flags of convenience" to ship owners (companies that don't have an agreement with a maritime AFL/CIO radio operator's union), the possibilities have also increased. Without any prior ship radio operating experience, it can be tough. But serious listening on the maritime CW frequencies, and close study of the radiotelegraph procedures in the text, can give you the knowledge and confidence to tackle a first assignment. See the table for frequencies.

Training Programs

Certainly, the least complicated way to go would be through acceptance into a union training program. The two major maritime radio officer unions are: The American Radio Association, M.M.&P, 26 Journal Square, Suite 1501, Jersey City NJ 07306-4168, (201) 795-5536; and The Radio Officers Union, 1415 Moylan Road, Panama City Beach FL 32407, (904) 234-8448.

These maritime unions have agreements with shipping companies to provide licensed radio officers for their vessels. Depending upon their membership needs, the unions have programs for persons with the Second Class Radiotelegraph license, but without the Six Month Service Endorsement. Upon acceptance into the program, you would sail as assistant or apprentice radio officer, gaining service time (endorsement time) under an experienced radio or radio-electronic officer. Both the A.R.A. and the R.O.U. have resident schools, where their qualified R.O.s can take the necessary courses to obtain certification as a radio-electronic officer, with the opportunity for taking advanced courses after certification.

Signing maritime mobile has led to many QSOs where I've been asked about the seafaring life, and how one becomes a ship's sparks. Getting that information on your own can be frustrating. This article should give you a good idea about what those "sparkies" out on the high seas are doing, and about those faraway places. Ready to pack your seabag? 73

Maritime CW (W/T)
Working Frequencies (kHz)

4188.5	to	4219.5
6285.0	to	6324.3
8377.0	to	8435.5
12565.5	to	12651.0
16754.0	to	16858.5
22250.5	to	22261.5

Sample Ships SITOR (F1B)
Working Frequencies (kHz)
Dial Setting

4170.8	4174.8
6257.4	6365.8
8344.3	8356.8
12489.8	12516.3
16658.8	16688.3
22197.8	22220.3

You can contact Michael A. Davidson N0MM at 1118 13th St. (A-54), Boulder CO 80302. Don't expect a quick answer, though; he could be anywhere in the world right now! The last we heard, he was in Saudi Arabia.

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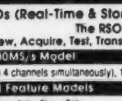
V-1085	100MHz Quad Trace w/Cursor	$2,045
V-1100A	100MHz Quad Trace w/Cursor	$2,295
V-1150	150MHz Quad Trace w/Cursor	$2,775



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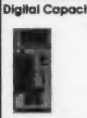

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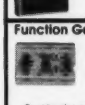

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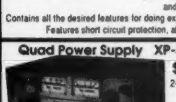

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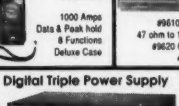

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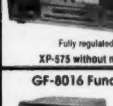

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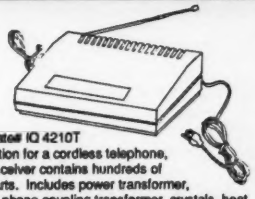

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CIRCLE 194 ON READER SERVICE CARD

73 Review *by David Cassidy N1GPH*

The ICOM IC-726

The HF+6 road warrior.

ICOM America, Inc.
2380 116th Avenue N.E.
Bellevue WA 98004
(206) 454–7619
Price Class: $1,300.

At the beginning of last summer, television reception in the non-cable towns and villages of central New Hampshire turned strange. Every night, stations usually received with extreme clarity were fuzzy and filled with interference for most of the evening. For the rest of the world, this was another of the minor inconveniences of living with old-fashioned broadcast TV. For a ham, it could mean only one thing: 6 meter DX!

Signals were coming from places like Texas and Florida (I even saw the ID screen from a Dallas station). With this evidence of great 6 meter propagation staring me in the face (literally!), it was time to take a look at some of the available 6 meter equipment.

On The Road

Not too long ago, getting onto 6 meters meant buying or building separate equipment for that band. But not anymore. Now you can get the 6 meter band included with your HF rig. ICOM took their IC-725, added 6 meter capabilities, and re-christened it the IC-726. I've had the chance to put in several hours behind the mike of this rig, and this is what I found.

The layout of the operating controls on the IC-726 is pretty straightforward. The mode selection buttons are stacked to the left of the main tuning knob, and the frequency controls are stacked to the right.

The first thing I did after unpacking the rig was throw it on the front seat of my car, attach the antenna and power, and tune in the 20 meter band. Then I started driving the 40-minute commute home from work. After scanning the phone portion of the band with the tuning controls on the supplied microphone (a very handy feature for mobile operation), I called "CQ." For the next 20 minutes I had a very enjoyable QSO with a gentleman in Florida. By the time I pulled into my driveway, my hands were finding the controls without looking at the rig. Even switching bands was no problem; you just push the button marked BAND, use the mike controls to select the band you want, then push the BAND button again. A quick glance at the frequency display, and that's all there is to it. A push of the LOCK button disables the main tuning knob but leaves the UP/DOWN buttons on the microphone functional, so bumping the main tuning knob while reaching for the volume has no effect.

This was my first experience with mobile HF, and I was hooked. The IC-726 is now my constant copilot during my daily commute.

Back in the Shack

Once I arrived home, it took only a few seconds to set up the IC-726 at the operating desk. There is a plate on the back of the rig that tells what each jack, switch and plug is for, so the confident need not even look at the manual. In fact, this rig is so plainly laid out that anyone familiar with modern transceivers probably won't need to read what is, with few exceptions, a well-written instruction manual. (Once the initial excitement of any new piece of gear wears off, I would suggest spending 30 minutes or so with the manual, and if you are adding a linear amplifier or other gear to the chain, I would strongly urge that you take the time to go through the manual first.)

The spec rundown for the IC-726 is fairly standard for a modern HF rig: general coverage receiver, two VFOs, 26 memory channels (with two channels holding split frequencies), RIT, band and memory scanning, and variable tuning rates. One feature that I found very helpful was the built-in 10 dB preamp. Especially during mobile operation, that extra push in the signal-to-noise ratio can make the difference. The built-in noise blanker was also quite helpful in eliminating ignition noise. The backlit amber display is something else that I liked very much. All operating functions have an indicator, so you only need to look in one spot to remind yourself exactly where you are and what you're doing (another handy feature for mobile operation).

On-the-Air

I spent several weekends operating the IC-726 on every band, and in every available mode. Audio reports were consistently superb, even on AM where the newer rigs can't really compete with the audio quality of some vintage equipment.

Receiver audio is average, as long as you don't use the tiny speaker built into the cabinet. Almost any extension speaker will sound better. If you plan to go mobile with this rig, an extension speaker is a must. The built-in speaker started buzzing at relatively low audio output in the quiet of the shack. Mobile operation, even with the rig on the passenger seat and the speaker facing directly at me, was next to impossible.

This is really not a criticism of the transceiver. In order to put a larger speaker in the cabinet, the cabinet would have to be larger. Consider the built-in speaker as sort of a back-up, and you'll have no problems or complaints.

As stated earlier, band changing is a snap. Tuning is very smooth and precise, even when tuning down to 10 Hz steps. The knob tension is easily controlled by a front panel screw, so those who like a looser or stiffer tuning can be accommodated.

What passes for tuning up in a modern transceiver is quick. Set your power level, check your SWR, and you're on the air. The IC-726 will give you 100 watts (40 watts in AM mode) on 160–10 meters and 40 watts (10 watts in AM mode) on 6 meters into an SWR of 1.3:1 or better. The automatic protection circuits kick in at higher SWR and your total output will be reduced accordingly.

QRP operation is a simple matter of turning down your RF power. Even when the power is turned fully counterclockwise, you'll still get about 10 watts output. This is due to the idling current supplied to the driver and final transistors to obtain bias voltage. If you want to operate serious QRP, a simple attenuator could be put in line.

What I Liked

1. Of course, 6 meter capability has to top this list. It's great to have that extra band. You don't get it for free, though. Only you can decide whether or not its worth around $300 to have the extra band. The way I look at it, you're already spending a lot of money so you might as well shell out a little more.

2. The front panel layout of this rig is excellent. Mobile operations are safe and easy.

3. The variable tuning steps are easily accessible. If you want to go from the FM portion of 10 meters to the Novice/Tech SSB subband, a simple button push lets you tune 1 kHz or even 1 MHz at a time.

3. The 10 dB preamp is great! I never realized I needed one until I had one. Now, I couldn't live without it.

4. The back-lit amber display is well thought out and easy on the eyes. Everything you need to know is contained in about four inches of space, which adds another safety margin in mobile operation.

5. The band stacking registers will remember where you were the last time you were tuned to a certain band. At first I thought, "big deal," but I found this feature very useful. Before tuning to another band, I always leave the VFO on a special frequency (the center of the phone portion, or maybe a net frequency). As I'm scanning the bands, that special frequency is waiting for me when I return.

6. The smooth and precise tuning is a real plus. Many rigs get a bit cranky when you're tuning 10 Hz steps. The IC-726 was easy to tune and never wavered.

What I Didn't Like

1. ICOM's biggest sins are sins of omission. It would be nice if the tone encoder and CW filter were standard instead of options, but to not include the carrying handle. . . shame, shame, shame. For a rig that is marketed as a base/mobile unit, the carrying handle should be standard equipment.

2. The manual falls short in helping you set up digital modes. In today's world of packet TNCs and multimode controllers, the transceiver manufacturers ought to get a bit more specific on how to set up their rigs for these modes.

3. The noise blanker circuit does not operate in the AM or FM modes. This made mobile AM work rather aggravating.

Options

ICOM has an extensive line of options for the IC-726. These range from the standard

"Now you can get the 6 meter band included with your HF rig."

choice of power supplies, antenna tuners and external speakers, to a programmable tone encoder, mobile mounting bracket, and the missing carrying handle.

The CR-64 high-stability crystal unit will improve frequency stability, especially if you will be operating in extreme weather (the CR-64 is rated from −22°F to +140°F). There are two different CW filters available. The FL-100 is a 500Hz/−6 dB filter, and the FL-101 is good for 250Hz/−6 dB.

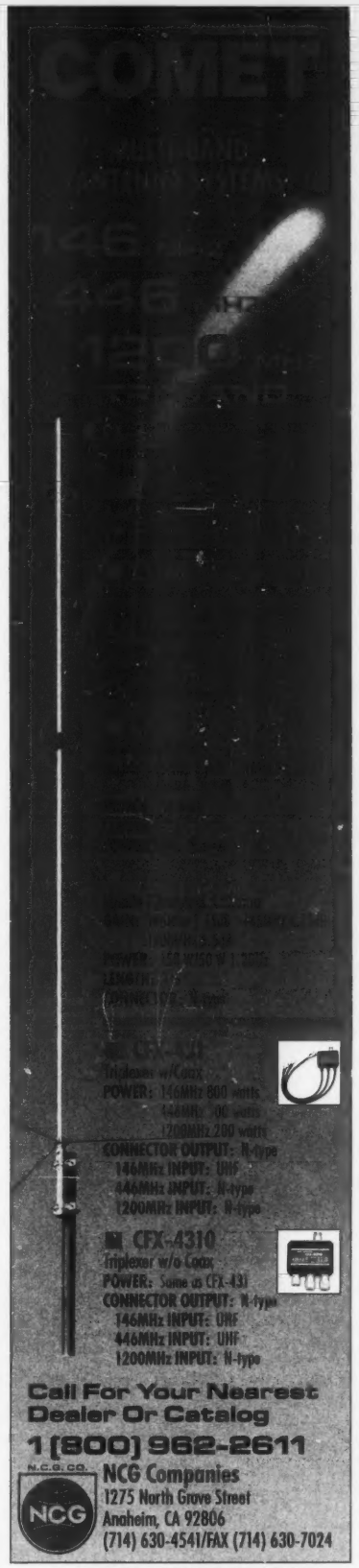
Other options include the CT-16 Satellite Interface Unit, which provides easy tuning for satellite communications, and the CT-17 Level Converter for remote control of the transceiver through your computer's RS-232 port.

Final Comments

ICOM's usual quality is evident in the IC-726. After two months of heavy use, including the daily switch from the shack to the car, the rig hasn't given any trouble. The simplicity of operation makes it a breeze to use, especially when going mobile.

If 6 meters is not your cup of tea, then you might want to save yourself a few hundred bucks and check out the IC-725. But if you're the type of ham who is always interested in putting your callsign out on another band or in another mode, the IC-726 is a great way to get on 6 meters with no hassles. The next summer DX season is right around the corner! 73

When he's not mobile or busy in the ham shack, David Cassidy N1GPH is Associate Publisher of 73 Amateur Radio Today. *You may reach him at* 73, *Forest Road, Hancock NH 03449.*



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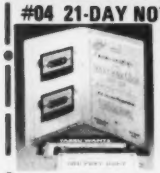

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CIRCLE 31 ON READER SERVICE CARD

73 Review

by Paul Grupp KA1LR

PT-340 Tuner-Tuner from Palomar Engineers

Adjust your antenna tuner without transmitting.

Palomar Engineers
1924-F West Mission Road
Escondido CA 92029
Tel. (619) 747-3343
Price Class: $100

The scenario repeats itself hundreds of times every day: Two hams are in the middle of a QSO. Conditions are less than ideal, and both operators are hunched over their rigs, straining to hear the other's name, QTH, and signal report.

Suddenly, an S9+40 carrier comes up on frequency, obliterating any hope of completing the QSO. Sound familiar? If you spend any time on the HF bands, you probably have lots of stories to tell about QSOs you've lost due to "carrier pollution."

Tuning Your Tuner

Some of the carriers whining away on the HF bands come and go with such precision that they are obviously the work of some fruitcake intent on disrupting communications. Fortunately, the number of carriers transmitted as intentional jamming is small compared to those used to tune up rigs, amplifiers, or tuners.

You'd have to be living under a rock not to know that you're supposed to use a dummy load to tune your rig or amplifier. However, a surprisingly large number of hams are unaware that there is also a method of accurately tuning an antenna tuner without transmitting a carrier, which brings us to the subject of this review: The Palomar Engineers PT-340 Tuner-Tuner.

The Tuner-Tuner allows you to adjust an antenna tuner without transmitting. On the front panel of this simple device is a rotary switch with two positions, OFF and TUNE. A red LED flashes rapidly whenever the switch is in the TUNE position. On the rear panel are two SO-239 connecters, one marked TRANSCEIVER and one marked TUNER. A 9 volt battery clip and battery holder are also provided.

Just Hook It Up

Installation and operation couldn't be easier. Simply connect the Tuner-Tuner between your transceiver and antenna tuner, and set the front panel switch to TUNE. (You'll hear a loud hissing noise from the transceiver.) Tune the receiver to a frequency near where you wish to transmit, and turn its AGC off. Then adjust the tuner's controls until the noise level is as low as possible. Bingo! You've adjusted your antenna tuner for minimum SWR.

The Tuner-Tuner must be switched off before transmitting. The front panel LED flashes at a rapid rate whenever the Tuner-Tuner is on to help you remember this. If you forget to switch it off before transmitting (and believe me, you will at least once!) an AGX 1/100 amp fuse protects the unit against damage. One spare fuse is provided, and a good thing, too. Just try finding an AGX 1/100 amp fuse at your local hardware store.

Tuner-Tuner In Use

I installed the Tuner-Tuner in my shack just after moving to a new QTH. This provided perfect conditions for a test, since the tower was still in pieces on the ground, and the only antenna installed was a 100-foot wire about 35 feet high, center-fed with ladder line. The antenna was matched with an Ameritron ATR-15 antenna tuner, and fed with a Kenwood TS-940S transceiver. Since the antenna and location were not familiar to me, I had no idea what the correct settings for my tuner controls would be.

Ease of use varied from band to band. The first band I tried was 10 meters. Adjustment of the tuner's controls produced an obvious dip in the noise level from the TS-940S. On 15 meters the dip wasn't as obvious, and it turned out that the dip was an extremely narrow range that was very easy to miss when adjusting the controls. Once I found it, it was just as deep as the dip on 10 meters, but I had to adjust the controls carefully to avoid missing the dip altogether.

On 75 meters, the effect was exactly the opposite. The dip was wide and gradual, and large movements of the tuner's controls produced a barely noticeable reduction in the noise level. Switching the receiver to AM and following the S-meter helped. Dips in the noise level that were barely perceptible to the ear were immediately obvious on the S-meter.

In every case, the antenna tuner control settings I came up with using the Tuner-Tuner corresponded to a low SWR reading on the TS-940S built-in SWR meter. Most readings were around 1.2 to 1, which is a perfectly acceptable match.

My only complaint is that when the fuse is blown (by accidentally transmitting when the unit is on) the Tuner-Tuner still appears to work. The noise level is lower than usual, but the nulls still appear, although with incorrect settings of the tuner controls, resulting in high SWR. This could easily cause problems for a casual user who is unaware of the internal fuse. I'd like to see a mod that causes the Tuner-Tuner to go completely dead when the fuse is blown, removing any ambiguity about its condition.

Conclusions

After using the Tuner-Tuner for a few weeks, I find that it takes a little longer than to simply tune for minimum SWR while transmitting. But that's a small price to pay for eliminating my contribution to the carrier pollution problem. If even half of the amateurs who use antenna tuners used a device like the Tuner-Tuner, the outrageous level of carrier pollution heard on the bands would be significantly reduced. If you use an antenna tuner, you should seriously consider adding a Tuner-Tuner to your shack.

Contact Paul Grupp KA1LR at 22 Lawrence Street, Pepperell MA 01463.

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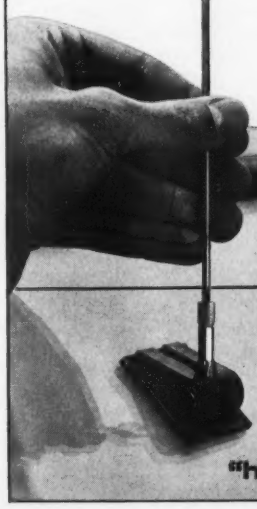

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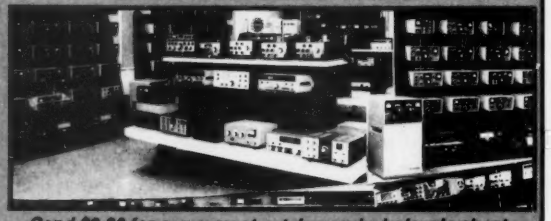

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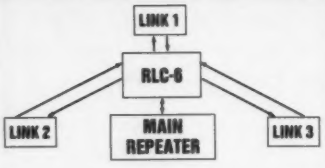

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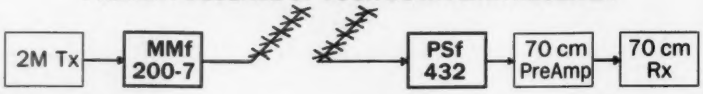

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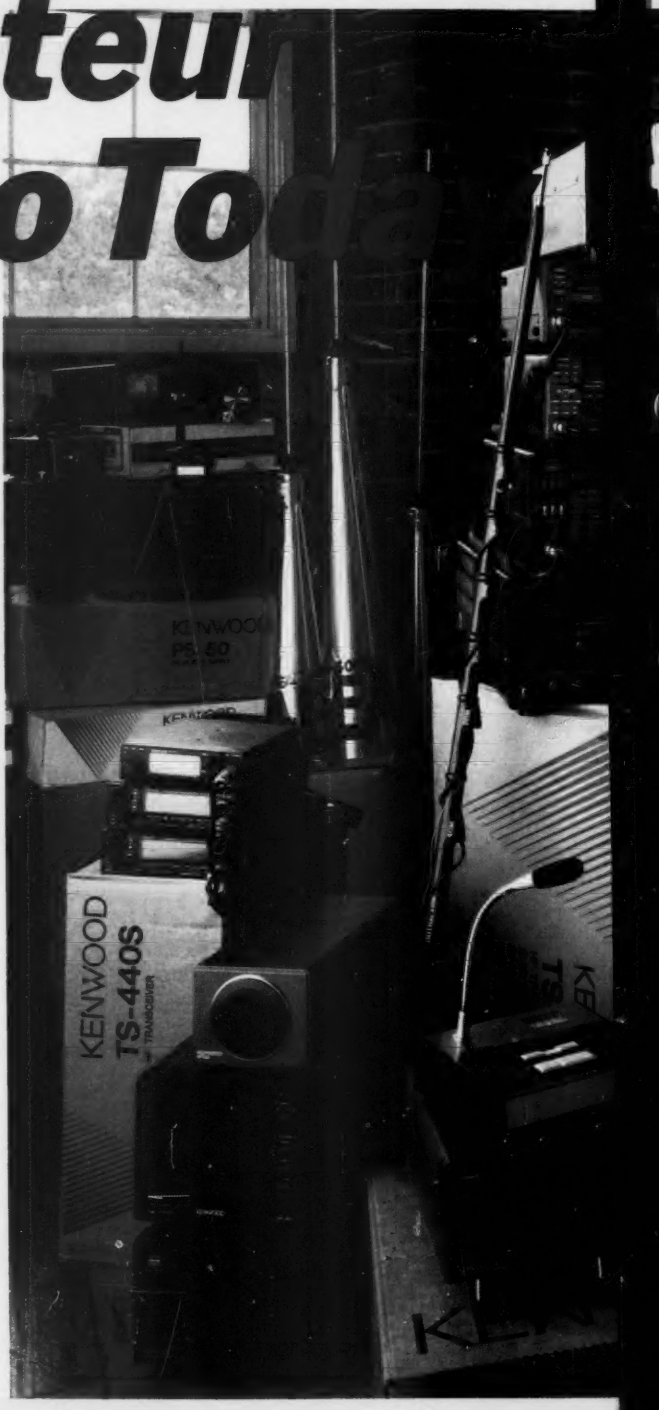

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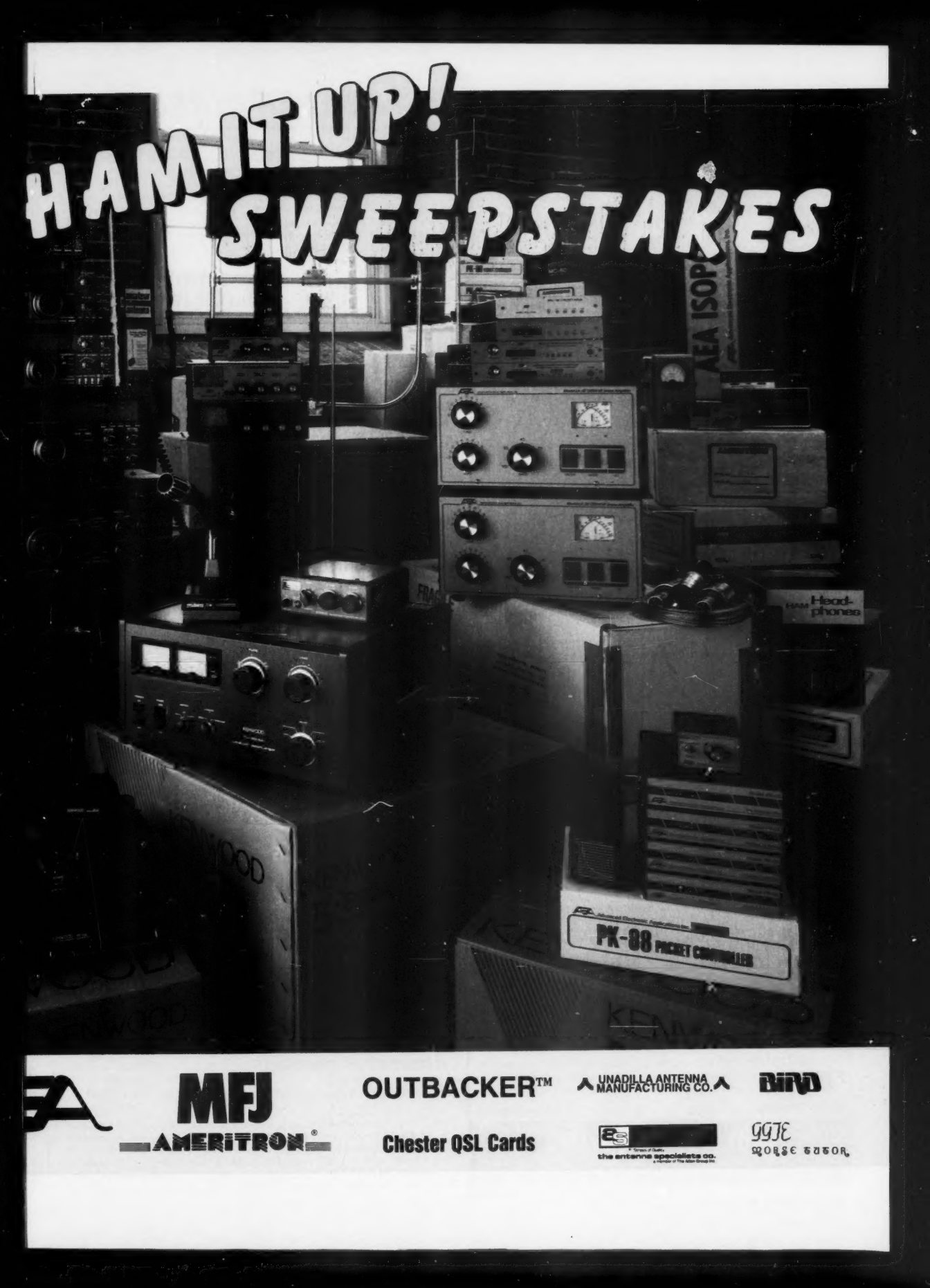

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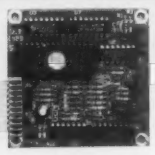

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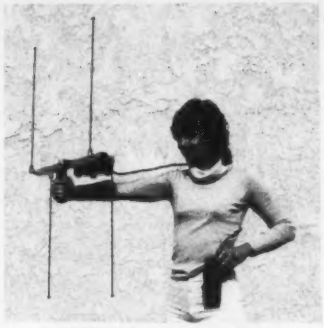

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73 from 72

The melodious sound of "73 from 72" has become familiar on 28.303 MHz every Tuesday and Thursday at 12:30 p.m. EST. Gordon West WB6NOA and I began The CQ All Schools Net two years ago in response to the ARRL's challenge to get more school kids exposed to the airwaves.

I open the Net as the East Coast Net Control from Intermediate School 72 in Staten Island, New York. With over 400 youngsters a term taking my course, "Introduction to Amateur Radio," we felt that the Net provided a great opportunity to involve our students with other schools across the country. Neither Gordon nor I realized that there were so many schools with access to ham radio. We were also delighted to receive letters from many teachers who were listening to us with SWL capabilities. In many cases, listening to the other children on the Net was the motivation for these classes to get involved in ham radio.

Either Gordon or Joe N6CRX is West Coast Net Control, inviting schools across America to check in with us. So many wonderful hams have been supportive by acting as relays during erratic conditions on the 10 meter band. We chose 10 meters so that all Novices would feel welcome to join us.

Benefits of the Net

As any good salesperson can tell you, it's important that your customers (in this case, students) experience a relevance to their lives when you're trying to sell them on an idea. The benefits of getting young people on the air talking to other youngsters are readily observable. Classes speaking with other classes in different parts of the world verifies that it's OK to have fun in school and on the ham radio.

Speaking with their peers gives the children a chance to discuss matters of mutual interest in addition to ham radio. Inevitably, friendships begin to form between the students at different schools. We began some follow-up activities which added incredible enrichment to our radio experiences. We'd like to share some of these ideas with other instructors who are concerned with keeping the interest level high.

One of the immediate benefits of enrichment activities is that every student can pursue his own particular interest at his own speed. Remember that in a regular classroom, ham radio should be used as the vehicle to motivate learning and to stimulate creativity in all other areas of the school's curricula.

Extras and Enrichments

A pen-pal exchange is usually the first follow-up to some really good QSOs. Recently, we spoke with Barry KB6RAA, a teacher in Los Angeles, California. The kids in his class had recently experienced a minor earthquake. What a difference it made to be able to speak directly to children who could tell us what the earthquake felt like from a child's perspective. My students were able to ask, "Was it scary? Did you go home or stay in school when the earthquake hit? What precautions do the schools in your part of the country take?" It was absolutely fascinating!

The Net has provided some real firsthand current events lessons for us. Many of the children in Barry's class exchanged letters with my classes. It was interesting to compare the newspaper coverage in their local Los Angeles papers with what we were reading on the East Coast. We had some real thought-provoking discussions in class about media coverage of disasters that we had been able to monitor ourselves in class on the radio.

The next step was to encourage the pen pals to make their own arrangements to speak with each other on the air. Any teacher would be thrilled to see the excitement that these "skeds" generate in the classroom. So many excellent communications skills come out of these follow-up activities that they really qualify as learning at its best.

Another terrific follow-up activity we do with some of the schools we've contacted is to exchange videos. We recently videotaped a tour of our school in Staten Island, showing the different types of classes and what the building and the surrounding community look like. Each child got on the tape and introduced him or herself and told something about their hobbies and likes and dislikes. We sent the tape to the Manchester Elementary School in Fresno, California, where we had made contact with the teacher, Bob Jost AA6AQ. In return we received a copy of the video that his students made for us. It was enlightening for all the youngsters involved with the exchange to see what a school in another part of the country was like.

After several months of wonderful exchanges of letters, pictures, videos, and "skeds," Bob and I decided to share our experience with other instructors. The following is an excerpt from Bob's writings on our coast-to-coast connection.

From Bob Jost AA6AQ

Amateur radio in the classroom has sparked a unique partnership between the students at Intermediate School 72 in Staten Island, New York, and Manchester GATE Elementary School in Fresno, California. These two schools at opposites ends of the country have been meeting on The CQ All Schools Net (28.303 MHz) Tuesdays and Thursdays at 1730 UTC, exchanging video-taped school tours and writing pen-pal letters.

For the sixth grade students at Manchester GATE (a Gifted and Talented Education magnet school in the Fresno Unified School District) and me, it started when we heard through the ham grapevine that WB2MGP and the kids from I.S. 72 were regularly getting on 10 meters to chat with hams all over the world. Several times during the fall quarter, we tried unsuccessfully to check into the Net. Then on January 23, 1990, it happened. We met Carole, and the kids had a great 20-minute QSO. We promptly mailed a QSL card and a list of class members. When a QSL card from New York arrived in Fresno, it created quite a stir. Several days later we met on the air again, and as we concluded our chat, Carole cryptically told the class, "You're going to like what we're sending you!"

Students at Manchester impatiently checked the mail every day to see if the "mystery from Staten Island" had arrived. After several days of disappointments, a thick package arrived at my home. The first item of business the following school day was the viewing of a wonderful video-taped tour of I.S. 72 led by several students. The tape concluded with Carole's class members introducing themselves. A lively discussion of the similarities and differences between the two schools and the kids with the "strange accents" followed.

The students in Room 21 quickly voted to write letters to their new pen pals and to produce a video-taped tour of our school. An exciting day of deciding what to film, planning camera angles, and scriptwriting followed. We decided to start with another CQ All Schools Net contact with WB2MGP. Conditions on 10 meters were dismal, but Jack N5PSJ in Friendwood, Texas, was able to copy both California and New York. As he swung his beam back and forth between the East and West Coast, Jack relayed the message that the videotape from New York had arrived in California, and that as we spoke, we were filming the Fresno video.

Most of February 15, 1990, was spent touring the school and filming the sights at Manchester GATE. The whole school was buzzing about "the kids in New York," and several other classes asked to see the Staten Island video. Students in Room 21 concluded the tape with each class member presenting a short monologue introducing themselves to I.S. 72. After some editing (the original tape was over 90 minutes long), the final copy was mailed along with the first batch of pen pal letters.

I established a marginal contact with WB2MGP on February 20 and several students managed to say hello to their new friends before fading signals ended the QSO. Then on February 27, Carole came right back when we called. The videotape had arrived! Sixth graders crowded around the radio in the back of the classroom to talk to equally excited New Yorkers. The pen-pal letters began arriving once or twice a week. Delighted kids claimed their personally addressed letters or vied for the ones addressed to "any sixth grade boy/girl" or "someone who likes 'The New Kids on the Block' " or "someone into martial arts." Return letters came back regularly. Some students bypassed the school mail and exchanged letters and photographs directly.

As the school year progressed, extended QSOs between WB2MGP and myself found the students talking about a variety of topics ranging from their favorite music groups and sports teams, the weather, school dress codes, after-school activities, homework, and all the other topics intermediate grade students find interesting. The students at Manchester regularly remind me when it's time to listen for WB2MGP. The letters may have slowed down a bit, but the interest in amateur radio and the excitement of talking to someone on the other side of the continent remains. Students in the after-school Ham Radio Club at Manchester GATE School are working on getting their own tickets, like "those kids in New York."

Station details: Bob Jost AA6QA, Room 21, Manchester GATE School, 2305 E. Dakota, Fresno CA 93726. (209) 441-6741. Or 5055 E. Hedges, Fresno CA 93727. (209) 255-9553.

Photo. The children did projects on earthquakes as a result of our contact with Barry's class in Los Angeles.

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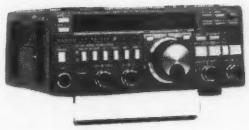

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Throw Your Voice

Surprises are what give competitive transmitter hunting its excitement. When you set out from the start point, you have no idea where you will end up or how long it will take to get there. Usually, you know nothing about what the fox's setup will look like. The hidden T could be a bunch of gear in an old ice chest, or a handie-talkie in the bushes. The antenna could be plainly visible in the clear, or cleverly camouflaged.

The hidden T's modulation seldom gives a good clue. One Sunday afternoon, I had the hunters checking under freeway overpasses instead of in the tranquil park where I was located. All it took was some tape-recorded speedway sounds playing in the background as I talked to the hunters.

Things get even more interesting when the hunters drive up to the hidden operator, but the transmitter and antenna are nowhere in sight. "You mean this isn't the hidden T? We've been listening to you talking." Some of my favorite hiding experiences have been times when I was able to watch all the fun from a nearby observation point, while talking to the hunters through a distant hidden transmitter.

A dual-band mobile transceiver makes this easy. Many models such as the Kenwood TM-621/631/721/731 series are easily modified to serve as a crossband repeater. Set it to transmit on the 2 meter hunt frequency, conceal it with a storage battery and antenna at the hiding spot, and talk through it on the 220 or 440 MHz band from your vantage point.

Dual-band hand-helds can make great remote hidden transmitters, too. On one Sunday afternoon hunt, I put an ICOM IC-32AT and a motorcycle battery down in a sprinkler hole along the Santa Ana River bicycle trail. I talked to the 2 meter hunters through the dual bander via 440 MHz. It was great fun watching the hunters wander around trying to figure out where the transmitter was, but there were some close calls—a couple of hunters almost stepped on the rig!

If you try this trick, be very careful to provide cooling for the radio. I wrapped the IC-32AT in a towel and put it in a plastic bag to protect it from jarring and moisture. In doing so, I gave it too much thermal insulation. I was only transmitting intermittently, but by the end of the hunt, the back of the hand-held was hot enough to fry an egg! (Well, almost.) Fortunately, it didn't fail. Next time I'll be sure to allow for free air flow and perhaps include a small fan.

The Fox Commander

Saturday night transmitter hunts in the Los Angeles area require the hider to transmit continuously. Some hiders use endless tape recordings to provide the continuous audio, but most have concocted some sort of tone/ID box. Adding remote control to either system is easy and provides a lot of convenience.

That brings us to this month's construction project. The Fox Commander is a simple, effective remote control system for your hidden T's push-to-talk (PTT) and audio. By adding the circuit Shown in Figure 1, you can "throw your voice," making short or long transmissions through the concealed bunny using your UHF handheld or mobile rig. The Fox Commander also lets you turn the target transmitter and its audio tones on and off with the control transmitter's DTMF buttons.

The heart of this project is a tiny (2½" x 1½") single-channel UHF receiver (Photo A). Originally designed for pocket pagers, it has a sensitive MOSFET input dual conversion circuit, with fractional microvolt sensitivity and excellent adjacent channel rejection. It draws only about 10 mA from a +6 volt power source.

These surplus UHF receivers are available for $12.95 each, plus handling charges, from Lynn Johnson Electronics (LJE). (Lynn WA6LNU has quantity prices for larger orders.) The LJE receiver has no speaker output stage, but this isn't necessary for this project. The audio output is just the right level to drive subaudible tone (CTCSS) and dual-tone (DTMF) decoders.

There is also no squelch on the receiver, but using a CTCSS decoder instead of carrier squelch makes your control link more secure. It also adds immunity to squelch trips from intermod and RFI. The MC3357 IF chip in the receiver has provisions for a carrier squelch, if you are willing to do some micro-surgery to add it, but I recommend the CTCSS method instead.

Crystalling Up

As shipped, the LJE receiver is tuned up on a 454 common-carrier frequency. The first thing to do is to decide on your control frequency and order a crystal (X1). Hams can legally do controlling anywhere in the 420–450 MHz band, except in the 431–433 and 432–435 MHz segments.

Choose a quiet frequency in keeping with the band plan in your area. A call to your UHF frequency coordination council may be in order.

Calculate the crystal frequency by subtracting the IF frequency (21.4 MHz) from the receive frequency, then dividing by nine. For example, a 47.1778 MHz crystal sets the receiver for 446.0 MHz.

Photo A. The matchbox-size LJE receiver mounts under the aluminum cover plate with adhesive foam. Keep the lead to the antenna connector short.

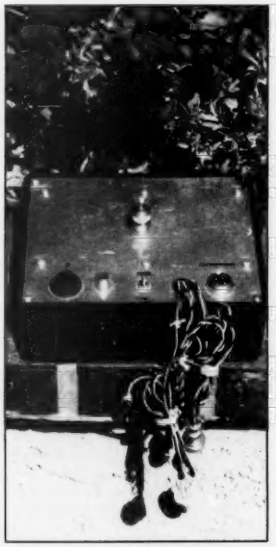

Photo B. The Fox Commander circuit fits easily inside the Un-Music Box. The aluminum cover plate forms a ground plane for the UHF control antenna.

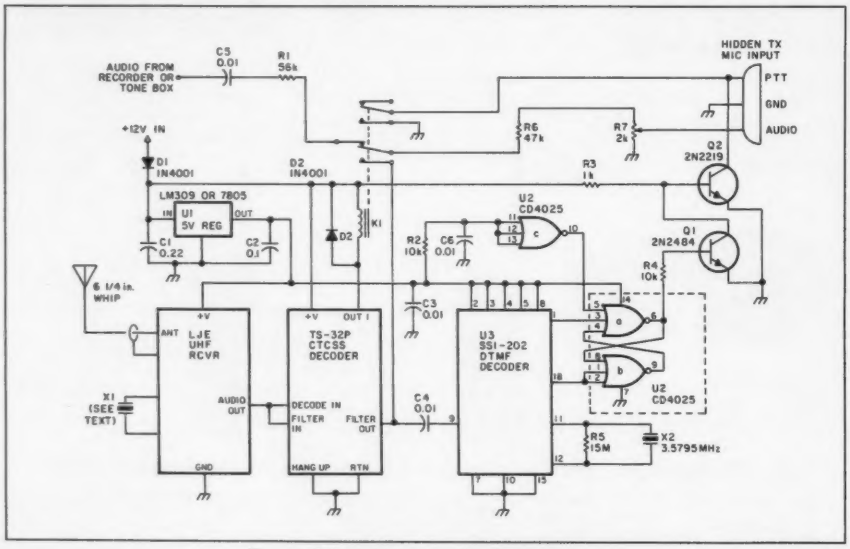

Figure 1. Schematic diagram of the Fox Commander.

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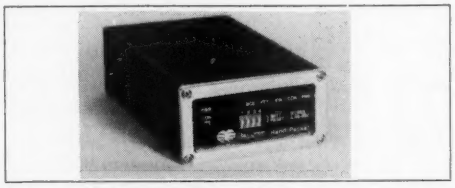

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DEC 1

APACHE JUNCTION, AZ The Superstition ARC will sponsor a Hamfest at the P&M Rodeo Grounds from 7 AM–2:30 PM. Admission $1, sales space $3. Talk-in on 147.12/.72. Contact *Chuck Kruppenbacher KB7ICP, (602) 986–3060.*

FARIBAULT, MN The annual Coupage Center Winter Hamfest will be held at the Eagles Club, starting with registration at 9 AM. There will be a Handi-Ham equipment auction, dinner at noon and program. Talk-in on the 146.79 repeater. Contact *Don Franz W0FIT, 1114 Frank Ave., Albert Lea MN 56007.*

DEC 2

HAZEL PARK, MI The Hazel Park ARC will sponsor its 25th annual Swap & Shop at the Hazel Park High School from 8 AM–2 PM. Advance admission $2, $3 at the door. Ticket and table reservations by mail: *H.P.A.R.C., PO Box 368, Hazel Park MI 48030.*

DEC 2

VERONA, NY The Madison-Oneida ARC holds VE Exams the third Friday of every month at the Madison-Oneida BOCES on Spring Rd. Time: 7 PM. Technician through Extra class tests cost $4.95. Talk-in on 145.37. Contact *Leonard Popyack WF2V. (315) 853–8974.* Can also be reached on *146.79, 145.37, WF2V @ WA2TVE, or POPYACK@TOPS20.RADC.AF.MIL.*

DEC 30

SOUTH BEND, IN The Repeater Valley Hamfest Committee will hold a Hamfest Swap & Shop at Century Center on U.S. 33. Tables $5/5' round; $15/8x2.5 rectangular, $20/8'. Walk locations. Talk-in on 52–52, 99–39, 69–09, 34–94, 145.29. Contact *Wayne Werts K9IXU, 1889 Riverside Dr., South Bend IN 46616. (219) 233–5307*

SPECIAL EVENT STATIONS

DEC 1–2

FLAMINGO, FL The Everglades ARC will operate W4SVI from 1400Z Sat.–1900Z Sun. to celebrate the 43rd anniversary of Everglades National Park. Frequencies: Phone–7.230, 14.240, 21.330 and 28.375; CW–7.030, 14.030 and 21.130. Send QSL and two units of postage for unfolded certificate to *EARC, PO Box 113, Homestead FL 33090-0113.*

DEC 15–16

NEW JERSEY The Major Armstrong Memorial ARC will operate W2XMN Sat. from 1300–1600UTC and Sun. from 1900–2200 UTC. Fequencies: 10 meters 28.400 ±25 kHz due to QRM. Special certificates will be sent to all stations making contact with us on those days and times. Please send a SASE (8½" x 11") to: *M.A.M.A.R.C., PO Box 581, Alpine NJ 07620.*

DEC 29–JAN 1

PASADENA, CA The Relay Repeater ARC will operate KE6PE from 1600Z–0400Z, Sat. and Sun., from the Wrigley Mansion, to commemorate the 102nd Anniversary of the Tournament of Roses. Frequencies: 14.260, 21.335 and 28.450. Amateurs in California/Nevada can contact the station on 2 meters via the club repeater 144.970/147.410 or on 220 meters via the Condor Connection. For certificate send QSL and 9 x 12 SASE (50 cents) to *Relay Repeater Club, PO Box 81, Arcadia CA 91066-5019.*

EVERY WEDNESDAY NIGHT Trivia Net is held every Wednesday night at 7:30 PM on the 145.17 and 224.56 repeaters located in Rhode Island. Net operators are *Dan KA1BNO and Lori KA1OCF.*

EVERY THURSDAY NIGHT The RI Technical Talk Round Table group meets every Thursday evening at 7 PM on the 223.88 (KA1PBS repeater). The purpose of the net is to help amateurs with answers to technically related subjects. The coordinator for the net is *Marc KA1EGY.*

Continued from page 50

I ordered my crystal from Cal Crystal, a local company. If you order from Cal, just give your receive frequency and state that the crystal is for the Lynn Johnson receiver. Cost is $12.50–$15.00 postpaid, depending on how fast you want it.

If you order from another crystal company, give the receive frequency and crystal frequency, and specify HC-18 holder, 400-size enclosure, and 8.5 pF load capacitance. Better yet, send along with your order the 454 MHz crystal supplied in the receiver. This will help the manufacturer make a crystal that fits and works perfectly on your chosen frequency.

With the crystal for 70cm installed, control range using a 6¼" whip antenna will be several blocks without any further tuning up. If you have access to a weak signal source or a signal generator, peak the RF and multiplier stages for maximum sensitivity. LJE supplies a schematic and parts layout with your order to help you find the tuned circuits.

The TS-32P CTCSS decoder ($57.95 from Communications Specialists) is ideal for this project because it has a built-in audio filter to buffer the received audio and get rid of the subaudible tone ahead of the DTMF decoder circuit. Before installing the TS-32P, use the supplied layout drawing to find jumper JU-1 and cut it.

The SSI-202 DTMF decoder IC is fast, non-falsing, and tolerant of audio input level variations. Better yet, it is cheap and works with an ordinary TV color burst crystal (X2). It's hard to go wrong with this circuit if you use good construction practices. Put sockets on U2 and U3, and check the wiring before plugging in the ICs. Bypass the U3 Vcc supply with C3 right at the socket.

A 7805 or LM309H regulator (U1) supplies +5 volts for all parts of the unit except the TS-32P and PTT control. The LJE receiver works fine at this slightly reduced voltage. Diode D1 protects you from the agony of reversing the 12 volt supply polarity and frying the circuit in your haste to get the fox on the air. (I learned that lesson the hard way.)

Photo B shows a typical tone/ID box with the Fox Commander installed.

Unless you plan to be a long way from the hidden station, a 6¼" whip is adequate for a control antenna. I never bother with an etched board for a simple non-RF project like this, since point-to-point wiring on perf board takes only a few minutes.

Beep—You're On

Operating the Fox Commander is simple. Just key your UHF control transmitter (with CTCSS on) and you are talking through the hidden T.

K1 closes, overriding the tone box audio with the control receiver audio. K1 opens when you unkey the control link. Flip-flop U2 a/b controls the hidden transmitter's PTT. Key the control link and press DTMF 1 to turn on the hidden rig; press 0 to turn it off.

Audio input can come from a portable tape recorder or your favorite tone generator circuit. (See: Moell and Curlee, "The Un-Music Box," pp. 193–200, in *Transmitter Hunting—Radio Direction Finding Simplified,* TAB Books #2701, available from "Uncle Wayne's Bookshelf"; and Morrow, "Hunt the Auto-Fox," in *73 Amateur Radio Today,* August 1985, p. 48.) Automatic CW identification is nice, but not necessary if you remember to identify your hidden transmitter by voice every ten minutes using the control link. Set R7 for proper deviation of the repeated control audio. You may need to change the value of R1 to equalize the levels between your audio source and the control receiver output.

Two transistors (Q1 and Q2) insure enough drive to close the PTT relays in most transceivers. If hunt rules call for regular, timed transmissions, just add a circuit to cycle the PTT off and on by pulling the base of Q2 to ground.

U2c sets the flip-flop to key up the hidden T automatically at power-up. This allows local use of the tone box without the control link, and assures immediate resumption of the fox's transmission if the battery connection is interrupted momentarily. If you would prefer the unit to come up in the OFF mode at power-up, remove the wires from U2-10 to U2-5 and U2-1 to U2-2, then wire U2-5 to U2-3 and U2-10 to U2-1.

Remotely operating your rig will add a new dimension of fun to being the hider, so get started on your Fox Commander. My next column will have more to say about the perils and pleasures of hiding. 73

Parts Sources

UHF Receiver: Lynn Johnson Electronics, P.O. Box 51268, San Jose CA 95151-1268; (408) 274–2534.

UHF Crystal (X1): Cal Crystal Lab, Inc., 1142 N. Gilbert St., Anaheim CA 92801; (714) 991–1580, (800) 333–9825.

CTCSS Decoder: Communications Specialists, Inc., 426 W. Taft Ave., Orange CA 92665-4296; (714) 998–3021.

Small Parts (Radio Shack Numbers)

SSI-202 DTMF Decoder (U3)	276-1303
Color Burst Crystal (X2)	276-1310
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Relay (K1)	275-241

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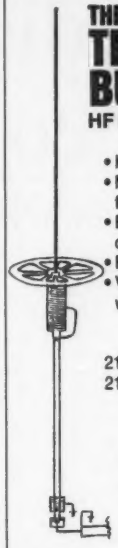

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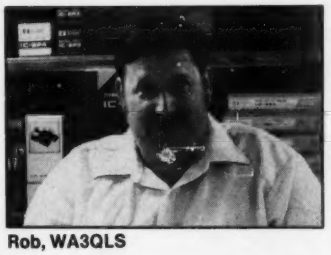

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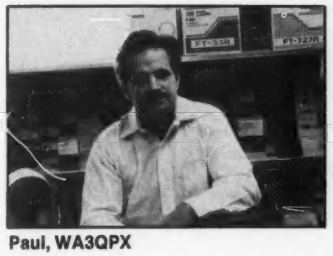

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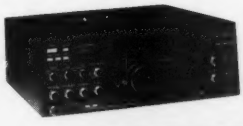

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Audio Powered Tape Recorder Controller

Add convenience to your hamshack.

by Gregory R. McIntire KE0UV

Have you ever needed a device that would turn a tape recorder on and off through the presence or absence of the audio being recorded? I wanted to record the transmissions from the Russian cosmonauts on 2 meters, but I could never be at home when they were active. I needed just such a device, with a few more requirements. In addition to stopping and starting on its own, I wanted it to operate without external power. I already have too many plugs in the wall. Nor did I want to use batteries, since the device would be in service for long periods of time.

Audio Activated Circuit

After much trial and error experimenting with various types of transistors, I devised a simple yet effective circuit. The finished device is basically a switch that will open or close any circuit (such as a tape recorder motor supply line or pause control), of up to 3 amps or up to 60 volts (it must not exceed 20 watts), by the presence or absence of an audio signal. It requires no batteries or power supply. The audio signal itself supplies the power to operate this switch.

The actual switch is a power MOSFET. Although it requires an extremely low amount of gate current for operation, it does require at least 4 volts at the gate. Voltage at an 8 ohm audio source is much less than 4 volts at normal audio listening levels. In fact, I consider the audio quite loud with a peak voltage of only 1.5 volts across an 8 ohm speaker. So, unless the audio source is a ghetto blaster cranked up to full volume, the voltage level of the audio must be increased in order for it to turn the MOSFET on.

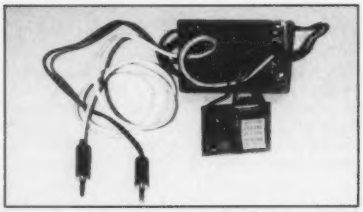

Photo A. The recorder controller circuit, housed in a small plastic box, is ready to be hooked up.

Increasing the Voltage

An 8 to 1000 ohm audio transformer is used for two purposes: First, it presents an 8 ohm load to the audio source (such as the external speaker jack of a radio), and secondly, it multiplies the voltage several times. It still does not step up the audio voltage enough at low or moderate volume levels, though. Therefore, I used a network of four diodes and four capacitors to *quadruple* the voltage output of the transformer. This reduces the available current, but there is still much more current than the MOSFET requires.

Since using an external speaker jack will usually disconnect the receiver's speaker, I included an external speaker jack in this circuit. A second jack supplies the actual audio source for recording. Except for a slight attenuation of the audio, caused by the resistors in series with the jacks, this device has no effect on the quality of the audio source.

Circuit Operation

Audio from an 8 ohm source is fed to the 8 ohm windings of a small audio transformer. The audio is also connected to two other jacks through appropriate resistors, to provide audio sources for external speaker and/or tape recorder input. The output (high impedance) windings of the transformer is fed to a "diode, capacitor voltage quadrupler circuit." This provides enough voltage to switch on the power MOSFET. A zener diode is used at the MOSFET gate to *clamp* the voltage to a safe level, since a *high* audio level from the source can be multiplied above the maximum gate voltage.

The output of the MOSFET (drain to source) does not supply any voltage or current, but rather acts as a single-pole, single-throw switch. This switch opens and closes the circuit of the tape recorder's motor via a relay in the tape recorder or via a remote control jack on the recorder. That is, the

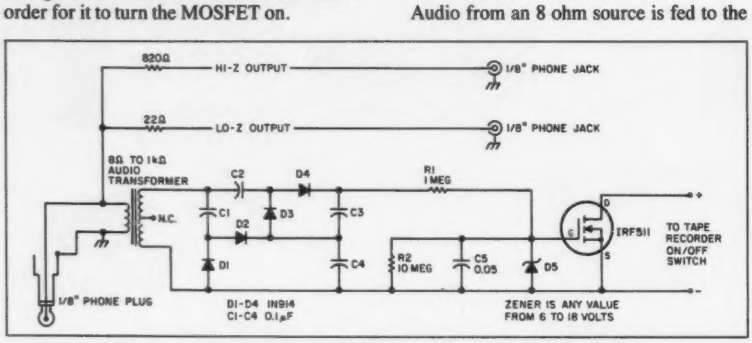

Figure 1. Schematic of the audio-powered tape recorder controller.

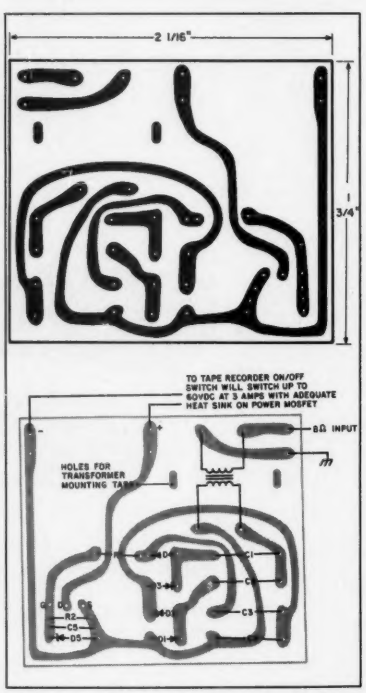
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Figure 2. (a) PC board foil pattern. (b) Parts placement.

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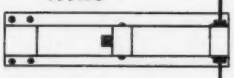

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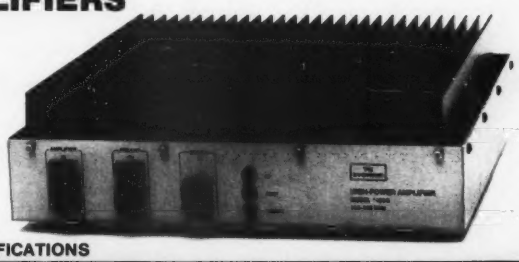

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Model	Freq. MHz	Power Input	Power Output	Preamp NF-dB	Preamp Gain-dB	DC +Vdc	Power A	RF Conn.
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0552G	50-54	25	400	.6	15	13.6	55	UHF
1450G	144-148	10	400	.6	15	13.6	54	UHF
1452G	144-148	25	400	.6	15	13.6	50	UHF
2252G	220-225	25	220	7	14	13.6	36	UHF
4450G	420-450	10	175	1.1	12	13.6	34	N
4452G	420-450	25	175	1.1	12	13.6	29	N

Models also available without GaAs FET preamp (delete G suffix on model #). All units cover full amateur band – specify 10 MHz bandwidth for 420-450 MHz amplifier. Continuous duty repeater amps also available.

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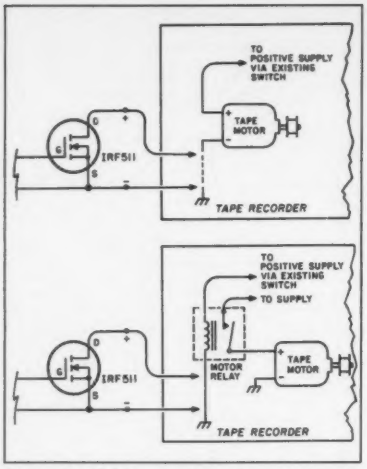

Figure 3. (a) Two methods of connecting the tape recorder controller to the motor of the recorder.

(b) Controlling the recorder via the built-in remote control/pause jack. [Ed Note: Some recorder pause controls have a grounded center pin; just switch polarities on the controller output in this case.]

Parts List

All components are available at Radio Shack stores.

1	IRF511 power MOSFET	RS 276-2072
T1	audio transformer	RS 273-1380
C1,C2,C3,C4	0.1 µF caps	RS 272-135
C5	0.047 µF cap	RS 272-143
D1,D2,D3,D4	1N914 diodes	RS 276-1122
D5	zener diode	RS 276-562*
R1	resistor	1 megohm
R2	resistor	10 megohm
R3	resistor	22 ohm
R4	resistor	820 ohm**
	plugs and jacks as required (see text)	

* Or any zener value between 6 and 15 volts.

** For tape recorder LINE input use an 820 ohm resistor; for MIC input use a 100k resistor or pot.

A blank PC board is available from FAR Circuits, 18N640 Field Court, Dundee IL 60118 for $3 + $1.50 postage.

MOSFET can be inserted into the tape recorder motor supply line if the recorder does not have built-in remote control ON/OFF operation.

Construction Notes

Any construction technique can be employed here, as nothing is critical about this circuit. I made a printed circuit board, as I find this method of construction simpler and more goof-proof than perfboard or point-to-point wiring.

I used a small plastic box (Radio Shack 270-230) to house the unit. I also wired one ⅛" mini phone plug to the input of the device and another such plug to the switched output, as my radio speaker jack and tape recorder ON/OFF jack are both the same. Use whatever type of plugs and/or jacks you need for interfacing your own equipment.

Although it wouldn't cause any damage to put the wrong plug into the wrong jack, I advise labeling the plugs. The IRF511 power MOSFET is internally protected against static shock, but it's still a good idea to take care when installing MOS devices.

Two jacks mounted in the plastic box are connected to the audio source via limiting resistors. They are used for a source of audio for the tape recorder and a source for an external speaker. The 22 ohm resistor is put in series with an external speaker because the transformer already provides an 8 ohm load to the audio source (scanner, transceiver, etc.). This also ensures that an external speaker will not drop the voltage below the threshold of the MOSFET.

Ready to Record

Plug the audio input side of the device into the external speaker jack of any audio source. Plug or connect the high impedance jack into the tape recorder audio input. (If your audio source already has a TAPE jack for recording, this will not be necessary, of course.) If your recorder has a LINE input, R4 should be 820 ohms. If you use the MIC input then R4 should be a 100k resistor or pot. The switched output of the controller should be hooked up to the recorder's PAUSE/REMOTE control jack (Figure 3b). If your recorder has no PAUSE/REMOTE control jack then you can connect the output of the device into the motor circuit of the recorder. If you use the direct connect method, the IRF511 MOSFET must be inserted into the negative or grounded side of the motor or motor relay (Figure 3a). Cut the wire on the motor and connect the drain pin of the MOSFET to the motor or the motor relay. Connect the source pin to ground.

Now turn on the tape recorder and set it to RECORD. Slowly turn up the volume of the audio source until the recorder motor starts turning. This should occur at a low to moderate volume level. If it doesn't, check your wiring and connections. Also be sure you have the polarity correct on all five of the diodes.

I tried several minor variations of this circuit (with different transformers, capacitors, and resistors) and it worked just as well. The main requirement is to send 4 volts minimum to the gate of the MOSFET to switch it on.

The MOSFET switches on fast, but when the audio source stops, it waits a second or two before it switches off. This way it doesn't switch off during pauses between words. At the start of a transmission, you rarely miss a single syllable, and the end doesn't drop off in mid-sentence.

For a couple of months now, I have been using this device, sometimes connected to the 2 meter rig and sometimes to a scanner. It works very well; and perhaps best of all, it doesn't require batteries, wall transformers, or any other source of power!

Gregory R. McIntire KEØUV, Hillsview Tr. Ct. Lot 92, Belle Fourche SD 57717.

RTTY LOOP

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ICOM Computer Control

At this time of year I am always torn between putting together a column devoted to gift giving—"Everything the RTTY/computer ham always wanted but didn't know how to ask for"—or a column devoted to suggestions on what to do while locked in the shack on these cold winter evenings. Well, some material on the latter topic crossed my desk, and it is so good, I just have to share it with you all.

I found this little gem in the amateur radio database on Delphi, and after discussing the matter with the SYSOP, I'm presenting it here. Carl Clawson N7KBV originated this piece on computer control of ICOM amateur radio gear.

N7KBV: Several ICOM products feature a built-in computer interface connected to a ⅛" phone jack on the rear panel. ICOM gives no information about this interface in the instruction manuals that I've seen, but my dealer managed to get it from ICOM for me.

This interface, called the "CI-V," is standard on the following models: 735, 761, 275, 375, 475, and R7000. Earlier models (751, 271, 471, 1271, and R71) used the CI-IV parallel interface, which can be connected to CI-V by ICOM's UX-14 converter.

The information I received was written with the 735 in mind, but a listing of a BASIC program to control the R7000 was appended. I believe it will help with the other models, too. The control codes and data format should be the same for all of them.

The computer interface allows you to do such things as: set and read the frequency and modulation mode; set VFO A, VFO B, or memory mode; select memory channel; store displayed frequency into memory; and transfer displayed memory-mode frequency to a VFO.

Even without a computer, you can run a cable between the remote control jacks of two rigs, and whenever the frequency or modulation mode of either is changed, the other will track it if possible. (If the rigs have incompatible frequency coverages, like the 735 and R7000, funny things can happen.)

The bidirectional interface uses TTL levels on a single line for sending and receiving serial ASCII data. You may need an appropriate hardware interface to convert the RS-232 to TTL, for example. (I understand Commodore computers have TTL inputs and outputs, and require no interface.) I used the Motorola MC1488 and MC1489 chips powered by two 9-volt batteries to interface to my RS-232 line. Table 2 lists the pinouts for this interface. If you'd rather buy something, ICOM sells the model CT-17 level converter for the RS-232.

The interface uses a "carrier-sense, multiple-access with collision detection" local area network protocol so that multiple rigs can be connected in parallel without difficulty. Thus, you can use the same RS-232 line and level-converter interface to control many rigs. Each rig must have a unique address, which is set by internal jumpers. Each model comes factory preset to its own address, which is 04 for the 735 and 08 for the R7000. Table 2 has information on the jumper settings.

In the following list, "receive" and "send" refer to data transmission. Thus a "receiver" isn't necessarily an R7000; it's any device receiving data from the CI-V bus. "Rig" means an ICOM product using the CI-V interface. The rigs send and receive data in variable packet lengths, formatted as follows:

Data Format

Byte #	Contents
1	hex 'FE' (i.e. 11111110 binary, 254 decimal)
2	hex 'FE'
3	<RX>
4	<TX>
5	<Code>
6-n	<BCD data of variable length>
n+1	hex 'FD'

The two hexadecimal FE bytes signal the beginning of a packet, and the FD byte signals the end. <Code> is the control code sent by the computer to the rig, which determines the action that the rig will take. In some cases, the receiving rig will include a control code in its response to the sender; see Table 1. <TX> is the address of the device sending the data, and <RX> is the address to which the data is being sent. When a rig responds to a data packet, it addresses that response to the <TX> in the packet. Thus, if your computer requests a rig to report its frequency, it will address that report to the computer and other rigs will ignore the data. (Of course, the computer can lie about its address and trick one rig into talking to another!) Your computer should use its own unique, non-zero address on the network. I will assume in the examples that the computer is at address 02. There are two control codes that can cause any rig on the network to respond when sent with <RX>=0; I discuss these below.

Bytes #6 through #n contain data required by the control code, in BCD format with 2 decimal digits per byte. Frequency data is sent starting with the byte containing the 1 Hz and 10 Hz digits. These digits are sent even if they are not used by the rig, so that the data format is the same for all rigs regardless of their frequency coverage and resolution. For example, 25.13244 MHz is broken up into two-digit groups: 25, 13, 24, and 40, then coded in BCD. In other words, consider each digit group to be a hexadecimal number instead of decimal. The decimal values of these BCD digit groups are 2 x 16 + 5 = 37, 1 x 16 + 3 = 19, 2 x 16 + 4 = 36, and 4 x 16 + 0 = 64. Now send these groups, starting with the least significant. The complete data packet will be, in hexadecimal: FE FE <RX> <TX> <Code> 40 24 13 25 FD.

If you have more than one rig on the network, you may occasionally receive a sequence of 5 bytes of hex 'FC'. This is the "jammer code" used by a rig to indicate that a collision has occurred. Each rig, when sending, monitors the interface. If it does not receive exactly what it sent, a collision occurred, i.e., another rig was sending data at the same time. If a rig detects a collision, it will send the jammer code as soon as the network is idle. A rig that receives this code realizes that a collision has occurred and ignores the previously received packet. Because the ICOM remote control ports are bidirectional, your computer will receive everything it sends, so you can check for collisions from your computer, too.

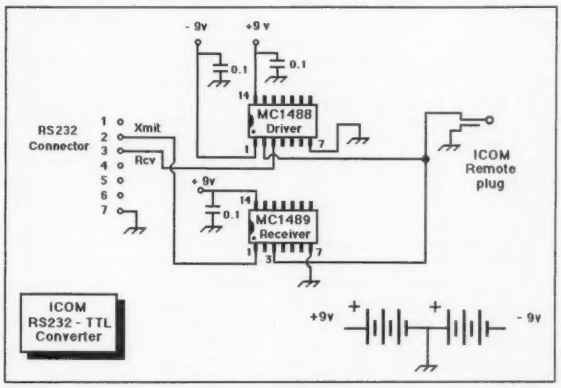


Figure. RS-232 to TTL converter.

Control Codes and Responses

Most of the codes are addressed to a specific rig, which addresses an acknowledgment packet to the <TX> contained in the control packet. The first two codes, 00 and 01, can be sent to the "group call" address, 00, in which case any rig will receive them without sending an acknowledgment. These two codes are sent in this way by any rig when its mode or frequency is changed by manual control, and are received by any rig on the network. This allows a number of rigs to track each other in frequency and mode without computer intervention. Rigs can be inhibited from sending and receiving group call packets by an internal jumper. See the tables for more details. These codes can also be sent with a specific, non-zero <RX>, in which case they will be received by the addressed rig even if the group call function is disabled.

Here are some examples for the 735. The 735 is at address 04 and the computer is at 02. First, let's find out what's in memory channel 1 (code 08 to set the channel, and code 03 to read the frequency). Assume the 735 has the frequency 7.12750 MHz stored in memory #1.

Computer to 735: FE FE 04 02 08 01 FD
735 to computer: FE FE 02 04 FB FD
Computer to 735: FE FE 04 02 03 FD
735 to computer: FE FE 02 04 03 00 75 12 07 FD

Now let's change the frequency and mode to 14.02500 MHz USB (codes 05 and 06).

Computer to 735: FE FE 04 02 05 00 50 02 14 FD
735 to computer: FE FE 02 04 FB FD
Computer to 735: FE FE 04 02 06 01 FD
735 to computer: FE FE 02 04 FB FD

Now store the new result in memory #1. This channel is already displayed, so all you need is code 09, the store command.

Computer to 735: FE FE 04 02 09 FD
735 to computer: FE FE 02 04 FB FD

RS-232 to TTL Converter

This is an easily built converter that will run your ICOM gear from a standard RS-232 line. You can build it in an hour or two for about $10. It uses two inexpensive, widely-available chips—the Motorola MC1488 line driver and the MC1489 line receiver (see the figure). The only other things you need are a box, connectors, a power switch, and a couple of 0.01 or 0.1 capacitors to bypass the power supply leads. I used two 9V batteries for power. Power for the 1488 can be ±9 to ±15 volts,

Continued on p. 59

LOOKING WEST

Bill Pasternak WA6ITF
28197 Robin Avenue
Saugus CA 91350

Handicapped Waivers: The View of an Expert

April Moell WA6OPS is opposed to the granting of waivers to handicapped individuals who claim that they cannot pass Morse code tests in excess of five words per minute. Moell is an expert in the field of rehabilitation of handicapped persons. Now in private practice, she spent 15 years serving as the Director of Occupational Therapy at St. Jude Hospital and Rehabilitation Center in Fullerton, California, where in 1977 she developed and introduced the Rehab Radio Program.

A licensed amateur since 1976, April Moell holds an Advanced Class ticket. She is an expert in the field of using amateur radio as a therapy tool. In this interview with me, as producer of Newsline Radio, she shares some startling insights into the issue of waivering CW testing for handicapped applicants for amateur radio upgrades.

Newsline: The FCC says that it will waive Morse test requirements for handicapped radio amateurs who claim that they cannot copy Morse code at speeds greater than five words per minute. What effect do you see this having on the handicapped in general?

Moell: I am concerned about it because people who are not disabled sometimes say things like, "Isn't this a nice thing to do for the poor handicapped?" which immediately puts everybody with a disability into one category. It is a put-down because you are saying to anybody with a disability, "You are not as capable as the rest of us."

We have many disabled people in the hobby who have shown us that they are equally capable, and in some cases, more capable. I can think of several hams who are deaf and blind, but who got licenses. I know a gentleman, a quadriplegic, who had to learn the 13 wpm code in his head because he is unable to write.

I think that putting all people with disabilities in one group, and assuming they are not capable, is a very bad precedent.

Newsline: You indicate that the general public does not understand who the handicapped are, and groups them all together. Has this been a problem for the handicapped?

Moell: The non-handicapped make a lot of assumptions about the handicapped. That has been an ongoing problem. The handicapped are individuals with individual differences and capabilities, just like you and me.

Newsline: In teaching amateur radio to handicapped individuals, have you ever run into someone who could not learn the code and who could not get a license?

Moell: Yes, I have, and those have been people who have suffered certain kinds of brain damage so that they cannot process adequately. I think that we have to have certain requirements [for becoming licensed]. If a person can't process adequately, he's probably not going to be able to function adequately on the radio.

I don't see it that differently from driving issues. You do not waive the requirements for a driver's license for someone who may not be safe as a driver. In the case of radio, [while] it might be nice for the severely disabled to hold licenses, if they cannot process information properly, they will not be able to operate correctly or safely with their equipment. But these persons can still enjoy amateur radio as a third party, with a licensed ham running the equipment.

Newsline: Could any of these people who were unable to learn Morse code have passed the theory exam?

Moell: If they haven't been able to handle the code, they often have not been able to handle theory, either, because they couldn't retain the information or became confused. Or they may have trouble learning new material, even though they might be fine with things they learned several years ago.

Sometimes the code has been a real boon for people with physical limitations because it's the only way they can communicate. Some have problems expressing themselves, and it's easier to communicate in Morse code than by voice. I'm concerned that if the FCC grants too many waivers, it'll decrease the pool of amateurs who are using code, and we may make it harder for the disabled people who need to communicate in code. They are not going to have anyone to communicate with.

Newsline: Then you consider the code a valuable tool for the handicapped?

Moell: Again, you can't group all handicapped people together, but I am aware of a number of disabled hams to whom code is the primary mode of communication. I think it's important that learning the code be offered to them [the handicapped]. To assume that because someone is handicapped, she or he can't learn the code is a very faulty assumption.

Newsline: Apparently this waiver system came about as the result of one person who contacted King Hussein JY1, who in turn contacted President Bush, who then contacted the FCC and said, "You will do this." Was it fair to the handicapped of this nation for the leader of another nation to dictate policy toward them?

Moell: This issue is really of serious concern to me—whether it has to do [primarily] with the handicapped or not. To have a citizen go to the leader of another country to gain something for personal benefit, and to have our government react as it apparently has, is appalling. I am as concerned about how this was done as I am about the result.

Newsline: The evidence is that this is what happened. Should the issue now be brought to our legislators or would an appeal to them be a waste of time?

Moell: I would hate to think that in our country that would be a waste of time. Maybe we won't get the decision reversed, but I certainly think that we should let our representatives know that we are not happy with that process. This might be considered small potatoes to some people [an issue important only to hams]. But what other things are going to be done this way?

Newsline: What about our other elected representatives, the American Radio Relay League?

Moell: I think that the League needs to take the lead in saying, "How did this happen, and why wasn't the ham community involved in it? Why weren't we asked about it? Why weren't opinions gathered?" I think the League should be very indignant about the process.

Nobody is saying that we shouldn't make reasonable accommodations for people with disabilities, and I think that reasonable accommodation is being made in the VE system. I have been involved in some of that, where we have had people with disabilities tested. But, we are not talking about that. We are talking about a process that was done in a very inappropriate manner, and I think that is where the League needs to focus.

Newsline: You are considered one of the national experts on using amateur radio in rehabilitation. You say you were never contacted? Do you find it a bit strange that the experts like you and Handi-Hams were left out of the decision process?

Moell: Yes. It bothers me to think that the leader of a foreign government can call and say, "Gee—what about this poor soul?" and have a policy changed [without our government] getting information from nationally recognized groups, especially the Handi-Hams, and the ARRL.

Newsline: How do you think handicapped people who fought for their licenses might react?

Moell: I would certainly hope that people [with disabilities] who currently have amateur licenses will share their thoughts and feelings about this situation. I think it would shed some light on the fact that there are many varieties of disability, and to show [our Congressional representatives] how dangerous and inappropriate it is to try to group everybody together.

There are hams who are essentially bed-bound or house-bound because of cardiac conditions. There are people who are blind, and who have severe cerebral palsy and limited motor control. They operate with mouth sticks and mouth switches and use Morse code! I would like to think that some of those hams will comment about what it took for them to upgrade and how they feel about this new policy.

Newsline: What about the future?

Moell: I am concerned about the precedent that we may be setting. Will someone claim that medication makes it hard to concentrate on learning the rules? Or that a learning disability keeps him from learning and using Ohm's Law? Will there soon be pressure for theory waivers?

Newsline: Playing devil's advocate for a moment, who are we the healthy to decide who should or should not hold an amateur license based on a physical or even a mental handicap?

Moell: I don't think we are deciding that. We're talking about guidelines, and I think we have set some up for people to operate reasonably and safely on the air. People who can meet those requirements with reasonable accommodation—who can show in some way that they understand the rules and regulations of safe operation and can understand the required code—should receive their licenses. It is not discrimination when you set up basic requirements and then let anyone who can achieve them be a part of the Amateur Radio Service.

I do not decide who can drive a car. What we do as a government is to set up guidelines saying that in order to drive, you have to pass these minimum requirements. Many disabled people drive. We make accommodations for them with hand controls, sensitized steering, and things like that. I don't see amateur radio as being different. We are not deciding that somebody with a particular disability should or shouldn't be in ham radio. What we are saying is that we have reasonable standards and we do what we can to help people meet those standards. I don't think it is inappropriate or unrealistic for us to say that not everybody should be able to upgrade.

Newsline: There are some who disagree with your position. A Mr. Moncure in Virginia feels that this waiver system does not go far enough, and it is a handout to the handicapped. He says he may again litigate to get all Morse code requirements eliminated for the handicapped. As someone who has worked with the disabled for so many years, how do you feel about a handicapped person like Mr. Moncure taking that view?

Moell: Maybe the code has been difficult for him, but there are some disabled people for whom theory is as much of a hindrance as code, just as in the rest of the ham population. Some have had problems with theory for maybe some of the same reasons that he cites as causing trouble with the code. It could be medication, but again I am concerned with the blanket approach that says all handicapped are the same. He assumes that everybody [handicapped] has the same problems, instead of focusing on ways he might help his own particular situation.

He sounds like he is bright and energetic enough, that I think he could pass a flexibly administered exam if he applied the same energy level and persistence to studying the code!

Newsline: Winding up, what would you like to see as a result of all that has happened?

Moell: I would like to see the FCC stop for a moment and take another look. Say [to themselves], "Hey, wait a minute, what are we doing? Is this really the right way to go? Let's talk with people who have had experience along these lines."

If, after careful study, the FCC decides that waivers are the way, I hope they will talk with groups like Handi-Hams, because I don't feel that all physicians can sign off for someone and say that that there is a good reason for them not to be able to learn the code. I think you need to have people who are experienced in the areas of physical medicine and rehabilitation making the decisions, and not the general practitioner or opthomologist, for example.

I hope that we will be able to get our leaders at the League and our leaders in Congress to take a look at the process and explain to us why they did what they did. That's what I hope for, and I also hope that nothing like this ever happens again, in this way.

Late News

On Friday July 13, the United States Senate passed, and sent to the president for his signature, the omnibus Americans in Disabilities Act of 1990. The House of Representatives had previously passed an almost identical bill, and President Bush promised to sign it into law as soon as it arrived on his White House office desk. The bill directs the public and private sectors to make sweeping accommodations for the nation's several million disabled citizens, and does this with the force of federal law. Peyton Moncure, the indivdual who has been the moving force behind abolishing all Morse code testing for handicapped applicants for amateur radio licenses, has vowed to use the terms of the act in court to achieve this goal before the end of 1990. It appears that the next act in this drama will be with Mr. Moncure. de WA6ITF

Continued from p. 57

Table 1. Codes and Responses

00 Set frequency. See the text for format of frequency data. See code 05 below for more details.

01 Set modulation mode. One or two data bytes are required to indicate the mode desired.

Data	Mode
00	LSB
01	USB
02	AM
03	CW
04	RTTY
05	FM
05 00	SSB (R7000)

02 Report tuning range. No data required. The rig will report its frequency limits in the format:

FE FE <RX> <TX> 02 <upper limit> 2D <lower limit> FD

(Hex 2D is the ASCII hyphen.) According to ICOM, some rigs report the lower limit first.

03 Report frequency. No data required. The addressed rig returns its displayed frequency to the sender in the format:

FE FE <RX> <TX> 03 <Frequency> FD

04 Report modulation mode. No data required. The addressed rig returns its mode to the sender using the codes listed above. Rigs with selectable bandwidth return an additional byte indicating the bandwidth in the format:

FE FE <RX> <TX> 04 <Mode> <Bandwidth> FD

Bandwidth Codes

Data	Bandwidth
01	Width 1 (widest)
02	Width 2 (narrower)
03	Width 3 (narrowest)

05 Set frequency. The data format is given above. If the data contains fewer digits than the rig uses, the digits sent will be changed and the rest will remain the same. If the rig receives valid frequency data within its tuning range, it responds with a packet containing the data "FB":

FE FE <RX> <TX> FB FD

If it didn't like the data, it responds with "FA":

FE FE <RX> <TX> FA FD

These acknowledgment codes are used by all following commands.

The 735 responds to out-of-range frequency data by sending the "FA" acknowledgement and: 1) If the frequency it receives is less than 0.1 MHz, it sets its frequency to 0.1 MHz. 2) If it received 4 bytes of frequency data more than 30 MHz, it sets itself to 30 MHz. And 3) if it received more than 4 bytes of frequency data, the data is ignored.

06 Set modulation mode. If one byte is sent, it sets the mode per the above table. If two bytes are sent, the second is the IF bandwidth.

07 Set VFO status. If no data is sent, the rig changes from MEMORY mode to VFO mode. If data 00 or 01 is sent, the rig sets VFO A or VFO B respectively.

08 Set memory channel. If no data is sent, the rig changes from VFO mode to MEMORY mode. If BCD channel data is sent, the rig changes to that memory channel.

09 Store displayed frequency and mode into displayed memory channel. No data required.

0A Write frequency and mode from displayed memory channel to a VFO. No data required.

and the 1489 requires +5 to +10 volts. With a suitable DC-DC converter chip, and a 78L05 or 78L08, you could power the circuit off of your 13.8-V supply. Or, if you're clever, you could figure out a way to trickle charge two 9V NiCds off of your RS-232 line. See Table 2 for pinouts and jumper selections.

There are jumpers in the ICOM rigs to set the device address and baud rate, and to enable the group call feature. You must look on the schematic to find them. The jumper to enable the group call feature is called the "transceive" bit by ICOM, and may be labeled with "TRV" on the schematic. The others are labeled "DBn" on the 735 and R7000; look for something similar. The rigs are factory-set to 1200 baud, transceive enabled.

The table gives specific information from ICOM on the 735 jumpers, and for the R7000 I make a likely guess based on the 735 codes and schematic.

Last Words

I certainly thank Carl for his fine work, and I hope that this material will enable many of you to more fully use the features in some of the more sophisticated amateur rigs.

Next month, who knows! Maybe I'll have something from you! You see, I really do read my mail, and I appreciate your comments, suggestions, and tips. Pass them along to me by mail, at the above address, or on Delphi (username MARCWA3AJR) or CompuServe (ppn 75036,2501). Until next time, my best wishes to you and yours this holiday season, for a Happy Hannukah, Merry Christmas, and a happy, healthy new year.

Table 2. Pinouts and Jumper Selections

	Pin	Connect to
For the 1488:		
	1	-V
	2	ICOM remote jack center conductor
	3	RS-232 pin 3 (RD)
	7	Ground
	14	+V
For the 1489:		
	1	RS-232 pin 2 (TD)
	3	ICOM remote jack center conductor
	7	Ground
	14	+V

Ground pin 7 of the RS-232 line and the outer conductor of the ICOM remote jack, and you're on line.

Jumper Selections

For the 735: The jumpers use lines labeled DB0 through DB5 at connector J22 on the PL board. Lines DB0 through DB2 set the device address. Line DB3 is the transceive enable. The baud rate is controlled by DB4 and DB5 according to:

DB4	DB5	Baud
0	0	undefined
1	0	9600
0	1	1200
1	1	300

The 735 is set at the factory to address 04.

For the R7000: The jumpers use lines DB0 through DB7 at connector J17 on the logic board. The address is set by DB0 through DB4; DB5 is the transceive enable, and the baud rate is set by DB6 and DB7. The factory address is 08.

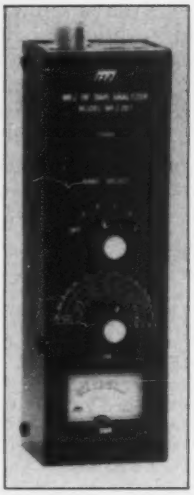
For other rigs: Determine the address by hooking the rig up to your computer and manually changing the frequency or modulation mode. You will receive a group call packet that contains the address of the rig as its 4th byte.

Number 20 on your Feedback card

NEW PRODUCTS

Compiled by Hope Currier

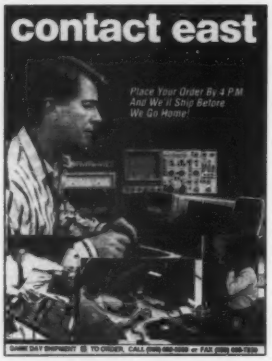
PRODUCT OF THE MONTH



MFJ ENTERPRISES, INC. MFJ-207

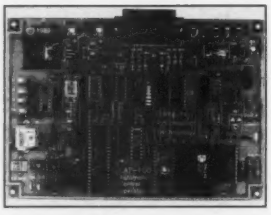
The new MFJ-207 HF SWR analyzer instantly gives you a complete picture of your antenna SWR over an entire band, without a transmitter, SWR meter or any other equipment. It makes setting up and trimming your antenna precise and easy. All you do is plug your antenna into the coax connector, set the MFJ-207 to the frequency you want, and read your SWR. It even has a frequency counter output, so you can connect your frequency counter for precise digital read-out. Plus, the MFJ-207 is battery-operated, so you can take it right to your antenna and measure the antenna's SWR directly, eliminating the distorting effects of the coax. Since you can immediately see SWR changes, you'll know right away which adjustments to make.

The MFJ-207 is priced at $100, and comes with MFJ's one-year unconditional guarantee. It runs on a 9 volt battery (not included), or 110 VAC with optional MFJ-1312 ($13). Contact any MFJ dealer or *MFJ Enterprises, Inc., P.O. Box 494, Mississippi State MS 39762; (601) 323–5869, FAX (601) 323–6551, TELEX 53 4590 MFJSTKV, (800) 647–1800.* Or circle Reader Service No. 201.



CONTACT EAST

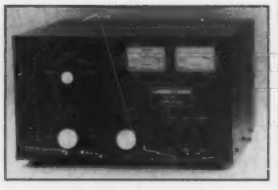
Contact East has released a new supplement to their general catalog. It includes thousands of tools and test instruments for testing, repairing and assembling electronic equipment, including many brand-name items. Product lines, shown in full color with detailed descriptions, have been expanded to include power supplies, oscilloscopes, soldering equipment, DMMs, EPROM programmers, tone test sets, inspection equipment, light meters, sweep/function generators, LCR meters and telecom testers. Also included are work benches, precision hand tools, tool kits, and our custom tool kits designed to meet your individual needs. All products are fully guaranteed. And if you place your order by 4 p.m., it will be shipped that day. To order this free catalog, call (508) 682–200 or write to *Contact East, 335 Willow Street, North Andover MA 01845.* Or circle Reader Service No. 205.



COMPUTER AUTOMATION TECHNOLOGY INC.

The CAT-100 automatic control operator will enhance your existing repeater system by adding features usually available only in controllers costing thousands of dollars more. The CAT-100's user-friendly voice and comprehensive manual make it easy to interface with your present controller. It is fully field-programmable, so you can customize the CAT-100 to meet your particular needs. The synthesized voice will announce the time, identify your repeater, and interact with you during control and programming operations. (You can select from seven different voice message announcements tailored to amateur repeater operation.) The scheduler permits automatic control of your repeater system. Sixty DTMF commands of up to 31 digits in length can be stored in the CAT-100 memory. Program the command and time, the CAT-100 will do the rest. Five user function switches, easy to change with a DTMF command, control equipment at the repeater site. A control authorization feature permits you to assign each control operator a unique prefix number, and individually limit their level of control. A computer interface is included.

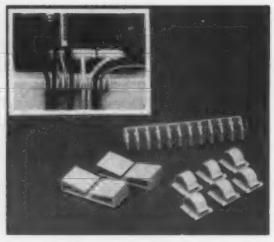
The CAT-100 is priced at $229. Contact *Computer Automation Technology Inc., 4631 N.W. 31st Ave., Suite 142, Ft. Lauderdale FL 33309; (305) 978–6171.* Or circle Reader Service No. 206.



AMERITRON

Ameritron has released a new 600 watt linear amplifier, the AL-811. The AL-811 uses three 811A tubes to deliver 600 watts PEP or 500 watts CW from 160–10 meters. (Easy modification instructions for 10/12 meters operation requires presentation of a valid amateur license.) A Pi-Network tuned input circuit matches the tubes to 50 ohm exciters. It lets even the fussiest solid-state rig perform flawlessly. A vernier reduction drive on the plate control makes tuning precise and easy. Dual illuminated meters give you a complete picture of your operating condition: One meter gives you a continuous reading of grid current; a second switchable meter lets you monitor high voltage and plate current.

The suggested retail price for the AL-811 is $600. For more information, contact your Ameritron dealer or *Ameritron, 116 Willow Road, Starkville MS 39759; (601) 323–8211, (800) 647–1800, FAX (601) 323–6551.* Or circle Reader Service No. 203.



CURTIS MANUFACTURING

Curtis Manufacturing Co., Inc. has introduced Cable Organizers, an inexpensive new system designed to keep computer and electrical cables neat and organized. Cable Organizers will straighten up those confusing cord tangles behind your equipment. A special custom labeling capability provides quick and easy cable identification. No more unplugging the wrong cord by mistake! Cable Organizers comes with: one 10-slot cord manager, two bundler clips, six runner clips, and ten blank peel-and-stick labels for custom labeling. Self-adhesive mounting allows quick and easy installation.

The suggested retail price is $10, including a lifetime warranty. Contact *Curtis Manufacturing Company, Inc., 30 Fitzgerald Drive, Jaffrey NH 03452; (603) 532–4123.* Or circle Reader Service No. 207.

FINE TUNING

Fine Tuning, a non-profit organization of senior radio hobbyists who specialize in shortwave broadcast DXing, has released the third edition of *Proceedings. Proceedings 1990* is a collection of in-depth reviews, articles and features for the SWBC DXer. Every article is written with expertise by leading radio hobbyists and thoroughly examined by a review panel of top-notch DXers. Included are reviews of receivers and accessories, six great DXing features, compendiums on DXpeditions and modifications for the Sony ICF-2010/2001D receiver, antenna articles, and much more. This year's edition is an essential reference for anyone wishing to increase their enjoyment and skill as a shortwave broadcast DXer.

Proceedings 1990 costs $19.50, plus $2 postage. For more information and prices for postage outside North America, contact *Fine Tuning Special Publications, % John Bryant, RRT #5 Box 14, Stillwater OK 74074.* Or circle Reader Service No. 204.

KUBY KOMMUNICATIONS

Kuby Kommunications' HT and scanner all-metal vehicle window antenna mount assembly is lightweight, compact, and durable. No tools are required—it comes ready-to-use, and it's easy to mount and remove. The mount can be slipped off and tossed into the vehicle for security, but with the window rolled up tight the mount is secure to the vehicle. No scratches on your vehicle's roof! This antenna mount was designed to be used with a supplied HT rubber ducky antenna that eliminates wind loading problems. Optional Beldon RG-58 or RG-174 coax cable is available.

The HT/Scanner BNC is priced at $20 with cable, $13 without, plus $2.50 shipping and handling. For more information, contact *Kuby Kommunications, 19254 Tranbarger Street, Rowland Heights CA 91748; (818) 964–1188.* Or circle Reader Service No. 202.

ABOVE AND BEYOND

VHF and Above Operation

C.L. Houghton WB6IGP
San Diego Microwave Group
6345 Badger Lake Ave.
San Diego CA 92119

5670 MHz LO & Converter

Browsing through back issues of *Feedpoint*, the North Texas Microwave Society newsletter, I found a design for a 5.6 GHz microwave building block PC board in the July 1988 issue. The original article was published in Germany and is used in this column courtesy of *CQ-DL* magazine, 12/87. Credit for this converter design goes to Roman Wesolowski DJ6EP and Jurgen Dahms DC0DA.

This project was just what the doctor ordered, even in time for Christmas. I could not believe the simplicity of the design and the methods for constructing such a truly fine converter for 5.670 GHz. This discovery completed the search for a working design that I thought was not available. Prior to this I was assembling components to put a system together, and I had not completed the gathering phase. This PC board made the job a lot easier. I have to praise our German amateur counterparts for their workmanship. See Figure 1 for the schematic.

Circuit Description

The circuit uses two GaAsFET amplifiers, one for the receive pre-amplifier stage, and the other for a transmit amplifier stage. The transmit amplifier provides about 5 mW power output and helps balance out the filter loss. The 5.6 GHz filters, interestingly designed, use two ¾-inch copper pipe caps with ¼-inch stubs for coupling into the filters. The depth of the stub determines the bandpass and filter loss. One-fourth of an inch is a good compromise. Each filter is fed from independent transmit and receive mixers, further simplifying the circuitry. See Figure 4 for details.

The mixers use any good mixer device, such as the economical HP 5082-2711 to the high performance stripline HP 5082-2794. Alpha 6-5827-00 stripline types are also suitable. The RFC for the 144 MHz coupling mixer input/output is an air-wound coil. I used 5 turns of #32 wire. If you want a form, use a 1 meg ¼W resistor.

Other parts for the PC board, such as the transmit attenuator, are common. Use carbon resistors, not wirewound types. The variable inductor L in the preamp stage is a NEOSID 5061. A suitable replacement can be made by winding 4 turns of #26 magnet wire over a ⅛-inch slug tuned form. The stripline PC board is etched from double-sided 0.031-inch Teflon™ stock. Leave the side opposite of the stripline unetched to act as a ground plane. After drilling the board, I used a ¼-inch sharp drill bit to ream out the holes on the ground plane to allow the components' leads to pass through without shorting out. Please note that those connections indicated with a ground symbol on the schematic should be jumpered from the stripline side of the board directly to the ground plane side. Most of the components including the pipe cap filters are mounted on the ground plane side. The chip capacitors, RF chokes, the mixer diodes and a few of the resistors are mounted on the stripline side. See Figure 2 for parts placement and the foil diagram.

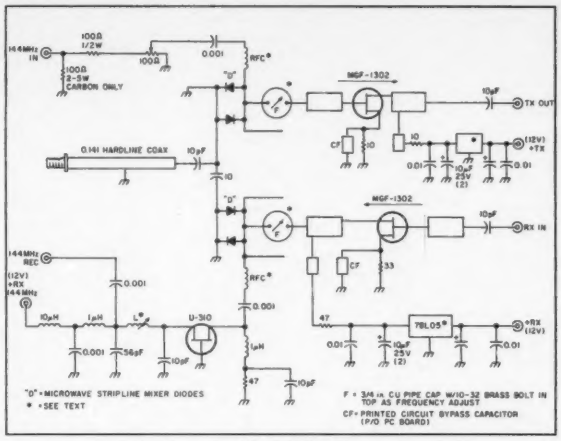


Figure 1. Schematic of the 5.6 GHz microwave converter.

Modifications

The IF system for this converter works at 2 meters and has an on-board U-310 receive 2 meter preamp. If you desire, you can replace this preamp with other preamps by coupling directly out of the U-310 input circuit.

I have made several modifications to the original PC board to suit my requirements. For example, I removed the crystal multiplier that was part of the local oscillator drive circuit. The system as originally designed used a crystal oscillator running at 117 MHz, and one tripler and five doublers multiplying the crystal frequency to 5616 MHz. The final doubler circuit, located on the main PC board, is driven by 2808 MHz from the oscillator PC board.

I modified the circuit by eliminating the crystal oscillator PC board and removing the multiplier (doubler) on the main converter PC board. I replaced this entire circuit with a 5.6 GHz, phase-locked "brick" local oscillator (see Figure 3). The brick provides a local oscillator output directly at 5.615 GHz. (5760 operating frequency - 145 MHz IF frequency = 5.615 GHz local oscillator.) This greatly improves stability and simplifies construction. There's nothing wrong with the multiplier string, but if a high quality oscillator is available from surplus, why not use it?

Phase-Locked Brick Oscillators

The phase-locked brick oscillator can be described as a compact, self-

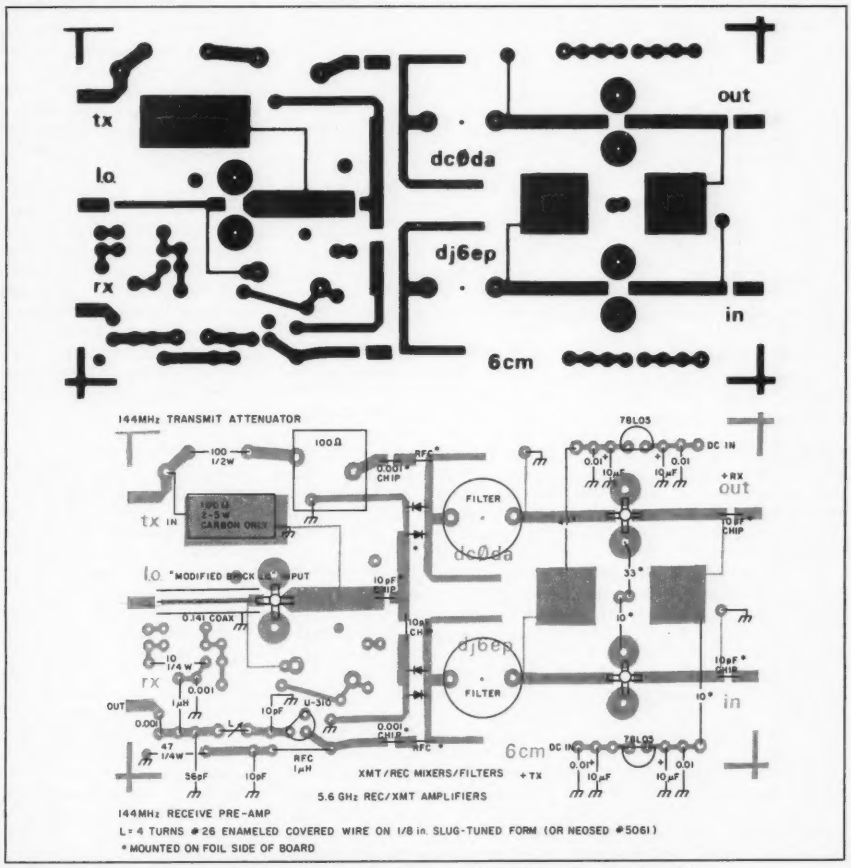


Figure 2. (a) Foil diagram and (b) parts placement (as viewed from stripline side).

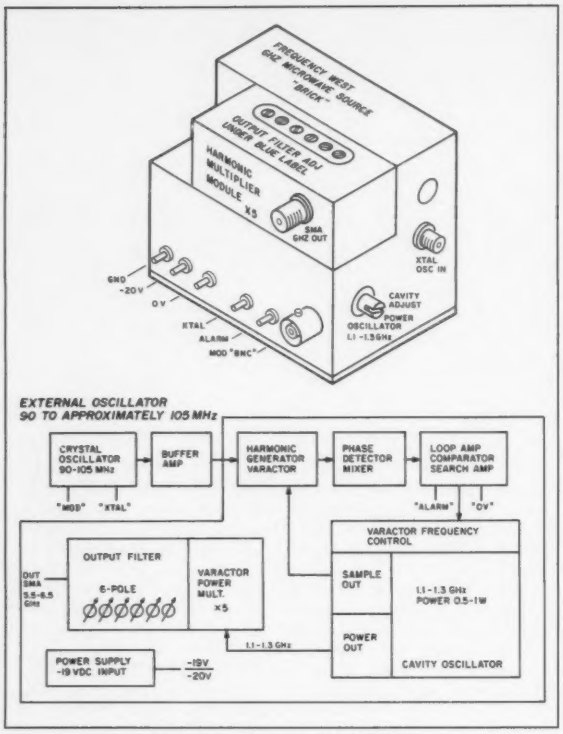


Figure 3. The microwave brick oscillator.

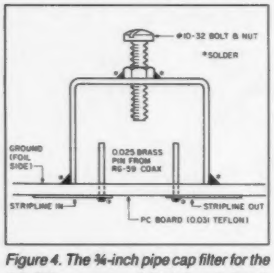


Figure 4. The ¼-inch pipe cap filter for the 5.6 GHz converter. Adjust the pin length for filter shape and loss (approximately ¼ inch long). Use RG-59/U center conductor leaving the foam insulation intact. Adjust the bolt for resonance at 5670 MHz or desired frequency.

contained system for local oscillator injection, hence the name "brick." Availability depends on the drifting winds of surplus. The circuitry internal to a brick is quite extensive; new, they cost about $1700 each.

Working surplus bricks were priced at $25 to $35 when they first started to show up, but prices on all microwave related components have been steadily rising. I have seen tested, certifiable bricks sell for a low of $50 and a high of about $75, depending on their condition. I've picked up bargain bricks at $5 each, only to find them in serious trouble.

The crystal oscillator for controlling the brick can be internal or external to the basic brick. The bricks with internal oscillators make the system simpler, but they are getting hard to find in surplus.

If the brick you obtain needs an external oscillator circuit, see the September and October issues of *73* this year, in which I describe a crystal oscillator circuit and a temperature control circuit in this column.

The brick I am using does not have an internal oscillator, so I've put the external oscillator and temperature circuit to use. It is a lot easier to build the crystal oscillator and buffer stage than the entire multiplier string.

Two transistors for a 100 MHz oscillator and a single op amp for temperature control are not difficult to put together. The external oscillator supplies the brick's harmonic generator, whose overall multiplication ratio is 60. That means that the crystal is multiplied 12 times, and controls the high power oscillator, phase-locking it at the 12th harmonic. A diode multiplier multiplies this phase-locked signal five times to the 6 GHz range. The crystal multiplier (12), times the harmonic multiplier (5), equals 60.

The oscillators showing up on the surplus market are coming from telephone companies, who are shifting from microwave to fiber optics for communications systems. Most equipment is junked out to scrap metal dealers at ten cents a pound. Now this sounds great, but don't forget that the bricks come with about 300 pounds of relay rack and support equipment. After this is removed, the junkyard still has the bulk of iron and unusable equipment left over. You have to find the brick oscillators before they're turned into scrap metal. People are catching on and demanding higher prices for them.

All is not a bed of roses, as you must purchase this equipment without any form of guarantee. My local scrap dealer has told me several times in price negotiations that: "You can't romance a junk man." Their price is firm! Looking for treasure in a scrapyard can be lots of fun, but it takes time and is wrought with dead ends.

Crystal Multipliers

Here are a few hints on how to properly tune a crystal multiplier for comparison. Some of the details are applicable to general building at higher frequencies. Component parts and construction techniques are very important, and not paying attention to detail will give poor results.

First, let's assume a multiple stage circuit like the original one used for the 5.6 GHz converter. Adjust each multiplier stage for a clean stable output, making sure the output is on the intended harmonic. Don't tune the circuit for maximum, as a system, by the tweak and peak method. Sure, it puts out power, but on what frequency? And what about oscillator garbage? I bet it'd have lots of false outputs and be somewhat unstable. It's better to tune each stage as a separate output before proceeding on to the next stage, making sure it's on frequency and not self-oscillating. (Pull the crystal; the system should be stable and not oscillate).

As I stated earlier, circuit construction techniques are very critical because at microwave frequencies, the size of the components becomes a larger and larger fraction of a wavelength. A short wire connection at low frequency can be a very large impedance, or RF choke, at microwave frequencies. Poor construction techniques and solder blobs can render a microwave circuit useless. Don't leave solder rosin on the PC board. Clean it with alcohol or other thinners. Just as you tune one stage at a time, do the same when building. Do not populate the entire PC board with component parts at one time. You could place most of the "nonvolatile" parts, transistors, and diodes only as needed while testing. This should minimize any circuit problems.

Mailbox Comments

Junji Tamara JH1MOY of Tokyo inquires about the brick oscillators for both 10 and 6 GHz bands. We are sending him details on the bricks. He reports that a 2.4 GHz repeater was settled in Tokyo recently, and activity has increased on that band. He believes that soon this wave of interest will cover all of Japan. Well, Junji, I hope the interest spreads and many other amateurs enter the fascinating world of microwave communications. I started in amateur microwave several years ago, being interested in building simple and practical circuits for our microwave bands.

Ray Kajma of Farrell, Pennsylvania, writes that he is looking for an APQ-110 radar manual. He's also looking into small antennas, and has researched a spiral antenna capable of operation over many GHz. A spiral antenna, like a log array, starts small in the center and spirals out, the dual elements getting broader as they circle out. Contact Ron at 317 Florida St., Farrell PA 16121.

Terry N8BIF questions the polaplexer. Does it function as a circulator and detector? Also, he wants me to describe my TWT and power supply. Well, Terry, the polaplexer is not a circulator, in that no magnetics isolate the detector from the transmit source. The polaplexer was first used over 40 years ago with tin cans of resonant size. The polaplexer derives its isolation from the fact that transmit is 180 degrees offset from the receive, one horizontal and one vertical in the waveguide or tube. Local oscillator injection is controlled by upsetting the inherent balance by a 8/32 brass bolt. This bolt is positioned at 45 degrees, and its depth of penetration controls transmit injection of current into the detector diode for bias.

The TWT or traveling wave tube that I use is a surplus item from telephone equipment for analog microwave transmitters that became obsolete. The TWT is a helix tube 6 to 8 inches long, its plate structure a spring-like, spiral-wound coil. It is surrounded by special magnets to contain an electron beam tightly focused in the coil. The power supply requires several high voltages—600, 1200, 3000 volts—which are adjusted to each tube type. Currents are quite low, in the 3 to 25 mA range for 10W types.

My TWT runs off 24 volts DC at 3 amps on transmit and has an output of 10 watts. My Field Day station has two options. One is the lower, more convenient solid state amplifier with 200 mW output for 12 volts at 1.3 amps on transmit. The other is the TWT with its power supply. The power supply is as wide as a relay rack (19 inches). It's 8 inches high and weighs about 10 pounds. The tube is 10 inches long in its protective case.

The large battery supplies that the TWT needs for a full day's operation (two 12V, 26 Ah) pose a problem for Field Day microwave contests. The battery might be overkill, but it can last a full weekend without recharging.

Bricks Available

By the way, I have obtained several extra 6 GHz brick oscillators similar to the ones described in this column. The bricks are as good as new, and I'll make them available for $50 each, postpaid U.S. They require an external oscillator (100 MHz crystal, approximately). All have been tested and are in good condition, phase-locking at 6 GHz, with the typical 6 GHz output 50 to 100 mW (+20 dBm maximum).

The last weekend of the ARRL 10 GHz Contest is about to start, and I hope to get some pictures to let you know what's happening. As always, I will be glad to answer any questions concerning this and other VHF/UHF microwave-related items. Please include an SASE for a prompt reply. 73 Chuck WB6IGP

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Still More Troubleshooting

Last month we discussed the ins and outs of various radio circuit stages, with a slant toward understanding and fixing them without schematic diagrams. There's plenty more to go, so let's get right to it.

Detectors: This is rather a broad area. The circuit configuration will depend, of course, on the mode (AM, SSB, FM, etc.) being detected. In a multimode rig, several detectors will be present. The simplest detector is the diode used in basic AM receivers.

You will find it hanging off the end of the last IF transformer. Generally, it either works or it doesn't. However, most rigs, even if they receive AM, avoid the diode detector because there are much better-performing schemes. The product detector is a balanced arrangement whose output is the product of a local oscillator and the received signal. By "product" I mean the mathematical kind, as in multiplication. So, this circuit has some gain, instead of the loss inherent in the passive diode detector. Also, by feeding in the BFO instead of the local oscillator, the product detector makes a very nice SSB and CW demodulator. Consequently, it is common in sideband HF rigs. As with all detectors, look for it at the end of the IF chain.

It may be an IC or it may have diodes, transistors or FETs. The giveaway is that it has two inputs and only one output. It is essentially a mixer, so it looks like one. If it doesn't seem to be working, check that both inputs are there before you start yanking any parts. If you do pull parts to check them, pull and replace them one at a time to avoid unbalancing the circuit by swapping "identical" components.

FM is another story altogether. Various detector schemes have been developed over the years, including the ratio detector, discriminator, pulse integrator, etc. The job of the FM detector is to convert wiggles in the incoming carrier frequency into corresponding voltages. The result of this process is reconstruction of the same audio signals which caused the frequency wiggles at the transmitter. Most rigs use discriminator-type detectors, which consist of two diodes and an IF coil with an extra winding. The coil has to be tuned to the unmodulated carrier frequency for the circuit to produce good audio. If it is even a little bit off, the recovered audio will be significantly distorted. I remember one rig that received clear audio when disassembled, but always sounded distorted when the case was put together. It turned out that someone had replaced the original, magnetically-shielded speaker with a cheap, unshielded one. The new speaker's magnetic field was detuning the discriminator coil when the case was assembled, because it was right on top of it! Moral: Never take **ANYTHING** for granted.

Some rigs use ceramic discriminators. These are small, pretuned, three-legged beasties. Because they have no adjustments, they can be looked at as either/or devices: Either they work, or they don't. They have no active components, so they usually work.

Pulse integrators are not common in radio equipment, but they are excellent, low-distortion FM detectors and are worth exploring, as they are handy for home-brewing. The idea is simple: Make narrow pulses from the incoming carrier by applying it to a monostable multivibrator (one-shot). Now integrate, or low-pass filter, the pulses with a simple resistor/capacitor (R/C) filter, and voilà, audio! As the carrier frequency increases, the "on" time of the pulses will be more frequent, causing the capacitor's voltage to rise. As the frequency decreases, the "on" time will be less frequent, and the cap's voltage will decrease. The fluctuating voltage will correspond to the original audio signal.

Low-level audio amps: If you have a signal at the output of the detector, but have no audio closer to the speaker, check the low-level amp stages. These are straightforward circuits, and they may be made of transistors or ICs. In some rigs they're op amps. In any event, their function is to build the signal up enough to drive the speaker amp stage. The signal voltage should get bigger at each stage or, in the case of an emitter follower stage, it should stay about the same.

You may wonder at the purpose of an amplifier that seems to have no gain. Why is it there? Because there are two kinds of gain. When the signal gets bigger, that's voltage gain. When it doesn't, the purpose is most likely current gain. In other words, the stage's output can drive a lower impedance load without getting wiped out. Current amplifiers are called "buffers," especially when they are made from op amps.

Noise blankers: There are various types, but the basic idea is to blank the audio output at the instant of a noise pulse because the brain finds the absence of sound far less intrusive than a sudden "pop." Blankers use a high-pass filter to look for noise pulses, which have a far faster rise time than normal audio. It can be hard to tell when noise blankers are broken. They can be pretty particular regarding which noises they will eliminate, even when they work. Unless you have some handy source of impulse noise, such as an electric drill, you will have to check components out-of-circuit.

Some noise blankers can be fairly complex, with variable levels, thresholds, time constants, etc. These can involve digital gates and decision-making circuits. Just as with the simpler variety, you need to inject noise to do any real troubleshooting. If you do try, simply trace the noise pulses through the high-pass filter into the noise amp and any circuits that follow.

Squelch circuits: These can fool you into thinking your low-level audio amps are not working because they gate the audio on and off. Some squelches have their own gate transistors, while others short out the base of the first low-level audio amp. If the amp doesn't seem to work, always check the squelch first.

Although some SSB rigs have squelch circuits, they are most common on FM rigs, where they're an absolute necessity because of the loud blank-channel "whoosh" which would otherwise drive you crazy. The usual FM squelch technique is to exploit that whoosh. The annoying noise contains lots of high-frequency audio energy which is outside the normal signal passband that would be delivered by a transmitting station. A high-pass filter, followed by a rectifier and smoothing filter, will deliver a DC voltage when the noise is there, and next to nothing when a carrier is present. (Even if there's plenty of audio modulation on the carrier, it will never approach the high-frequency content of the noise.) The output of the rectifier/filter drives the squelch gate transistor. Some squelch circuits can be a bit more complex, but the basic scheme is the same. If you have no audio, check the squelch gate. It may be shorted. If the audio's there but the squelch won't work, it may be open. Of course, check the input to the transistor first—the trouble may lie farther upstream.

AM/SSB squelches work just the other way around. They look for an absence of signal, clamping the audio off when the signal drops below the threshold you set with the squelch control. With AM and SSB, of course, there is no loud wideband noise because the IF stages are not being driven to their saturation point. In fact, a major objective is that the front end and IFs be as quiet as possible. The troubleshooting procedure is pretty much the same as for FM rigs, except that the signal levels in the early stages are inverted, and there is no high-pass filter. It all still comes down to a gate being driven by the received signal.

Audio power amps: These, of course, drive the speaker. Usually, the audio power amp is a current amplifier and does not exhibit voltage gain. If discrete, it is almost certainly a push-pull circuit, or some variation. In this scheme, there are two transistors and each one amplifies only one half of the audio waveform. Severe audio distortion in the power amp is nearly always caused by one of those transistors failing. If it is accompanied by hum which does not vary with the volume control, suspect a shorted transistor. If not, look for an open. Often, these transistors are matched pairs, and should be replaced the same way. Using off-the-shelf, unrelated parts can cause overheating and increased distortion. Also, when you replace a shorted transistor, be sure to replace any resistors connected to its emitter, as they may be damaged. If the transistors are good, see if there is a large, electrolytic cap between the amp and speaker. A shorted or leaky one will often cause symptoms which mimic a bad transistor.

IC power amps are becoming increasingly common. When they go, they usually get so hot you can't touch them for more than a second. If the audio looks good going in but nothing comes out, and the speaker coupling cap is OK, the IC is probably bad.

By the way, before you get too involved in tracking down power amp troubles, check that the speaker is good and is **CONNECTED**. A bad earphone jack or blown voice coil can waste lots of your time. Blown speakers are especially common in HTs because they are often played at high volume in cars. Also, some HT speakers are rated far below the power level the rigs' amps can deliver.

The Circuits

Now, let's look at some circuits peculiar to transmitters.

Speech processors: There are two types, AF and RF. The audio frequency processors usually are compressors, and work much like the automatic level control circuits on cassette tape recorders, only faster. They attempt to keep the average audio level close to the peak level. Although the RF technique has dominated for many years, AF processors have begun to reappear, and they are remarkably effective. If the processor passes audio but does not compress, check the variable gain element. Typically, it's an FET connected between the input and output of the amplifier stage passing the audio. If there's just no audio at all, check the amp itself.

RF processors are considerably more complex. They actually work at IF frequencies. The basic scheme is to take the modulated IF signal and deliberately overdrive it so that the peaks are clipped off. The result is that the average level is close to the newly-clipped peaks. To avoid the horrendous distortion and splatter this seemingly ugly process generates, the signal is then fed through a bandpass filter which smoothes the edges and keeps the signal within the normal 3 kHz limits. If there's no output, check all stages, starting from the processor's input, for the presence of a modulated carrier. You need to put audio into the mike, and you actually may have to operate your transmitter to do this test, so use a dummy load. Under no circumstances should you be on the air as you talk into the mike and start probing for signals. Needless to say, be careful to avoid injury when working near a live transmitter.

If the processor passes a signal but does not seem to have much effect on it, there probably isn't enough gain to drive it to clipping. Remember, below the clipping point, the whole thing is just an amplifier. You should be able to see the clipping on the signal at the bandpass filter entry point. If not, check the gain stages between the mike and the filter.

Well, once again I'm out of room, and we still aren't finished! Next month, we'll wrap this up and move on to something else. 73

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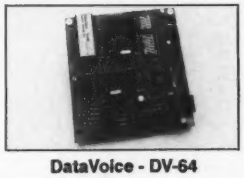
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The Variable Crystal Oscillator

When you start talking about QRP, without question the conversation turns to portable-mobile setups. Portable requirements are a bit different as opposed to home station use. Note, however, that when I'm talking portable, I'm really talking portable. Small rigs you can carry into places you wouldn't dare take a commercial rig. Wes Harward W7ZOI described such equipment in his mountaineering rigs. Smaller controls, less energy use, and frequency stability are utmost. In keeping with the topic of frequency control, this time we'll look at a special type of frequency control: the VXO.

The Variable Crystal Oscillator, or VXO, is a very good compromise between being rock-bound or using a less-than-perfect VFO. In portable use, a VFO can sometimes be extremely hard to keep stable, due largely to the temperatures you encounter in the outback. Mechanical stress also affects the stability of the VFO. It is difficult to keep capacitor stator-shaft bearings, drives and vernier dials operating correctly while sitting on top of a rock. A VFO will more than likely get bounced off frequency if the rig is dropped a small height, say off the top of our rock ledge onto the ground.

Comparisons to the VFO

A VXO can overcome most of the troubles affecting the VFO—at a cost. We lose a great deal of flexibility. Even the best designed VXO has a limit on the amount of swing one can "rubber" the crystal, depending on the frequency used. The type of crystal and circuit of the VXO will give us the required frequency spread. We can get about 2 to 12 kHz of swing. The lower the operating frequency, the less the amount of frequency swing. For 80 and 40 meters, you can look at about 2 to 4, maybe 5 kHz worth. As you go higher in frequency, you can achieve a much wider frequency swing. At 20 meters, you can have a VXO with a 10 kHz swing. On 15 meters, you can sometimes get a VXO range of 12 kHz—maybe more. Above 15 meters, you don't see too much use of the VXO, just too much ground to cover. You'll still need a shoe box full of crystals to cover all of the 10 meter band.

Because the VXO can give you crystal control stability with the movement of a VFO, now and then we'll see them used in VHF gear. Running the VXO at a lower frequency, we can get excellent stability with multiplier stages in the transmitter to achieve the required operating frequency. Changing the frequency of the VXO will result in a large frequency shift at the final stage. You'll see this scheme often used in homebrew 2 meter transmitters.

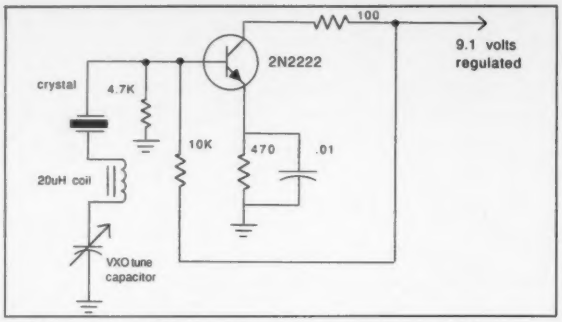

Figure. The classic VXO circuit. The inductor gives the crystal more swing.

Crystal Type

Often, the type of crystal you use will make or break the VXO. The popular FT-243 crystals will not work very well with a VXO. In many cases, the VXO just won't work at all. You'll find the frequency swing to be very little, and in some cases, unstable. The best bet is the AT cut crystals. I get my crystals from Jan Crystals *[see "Updates" in this issue for the correct phone number]*. I use a 30 pF load capacitance in a HC6/U holder. You can use the least expensive crystals; you're not launching missiles with these, so get the 0.01% tolerance rocks and put the change in your pocket.

I've used various VXOs in the past. Some have worked great and others have been vast disappointments. All but a few real poopers have provided stable operation.

The figure shows a classic VXO circuit. Note the coil in series with the crystal. This inductor gives the crystal an even greater swing. But you have to be careful not to increase the inductance too much, or you'll lose control of the crystal and the circuit will then become a VFO. You'll need to experiment. A good rule of thumb is to use about 15 µH for 30 meters, 20 µH for 40 meters, and 12 µH for 20 meters. Again, these are starting values. Nothing is set in stone, so you must experiment for accuracy.

Selecting Crystal Frequency

Deciding on the frequency of the crystal can be frustrating! I've found out the hard way that you just can't be sure where the crystal will oscillate! Another rule of thumb is to choose a crystal *lower* in frequency than what you need. Most VXOs will oscillate the crystal *higher* than the frequency marked on the crystal, so the VXO control will then allow for frequencies *higher* than the marked frequency.

If you order a crystal at 10.102 MHz, the oscillator will output a frequency of 10.102.7 MHz because of the 0.01% tolerance of the crystal. If the crystal is used in a local oscillator, you can add capacitance to *lower* the operating frequency of the crystal. Since we're not using the crystal in this application, we have to adjust the output to suit our needs. When we connect the VXO capacitor, we swing the crystal's frequency even *higher* than marked. With the VXO I have been using for some time, I can get about 7 kHz worth of swing, all on the higher end of the marked frequency.

Now just when you thought it was safe to break out the crystal catalog, you have to consider that some VXOs will move the crystal frequency both lower *and* higher than the marked frequency. This seems to happen when the Pierce crystal oscillator is used as a VXO. In most cases, the VXO will only allow you to move the frequency higher.

Even though the VXO is crystal controlled, be sure to include voltage regulation to the oscillator. You don't want a chirpy signal on the air. You can use a small zener diode. I prefer the 78L08 three-terminal regulator for VFO/VXO use. They're cheap, easy to use, and work great.

As in the construction of VFOs, be sure to enclose the circuit with some type of shielding. Double-sided PC board is great for this.

You may also want to use a vernier drive attached to the main VXO capacitor. This will help in tuning in the needed frequency. Sometimes the VXO capacitor and crystal combination cause a nasty little problem. The tuning becomes nonlinear. The frequency spread is not distributed evenly thoughout the tuning range of the capacitor. This results in having the entire tuning range of the VXO bunched together on one end. Best bet is to replace the crystal and or tuning capacitor.

Don't Overlook It

A VXO can prove a good trade-off between moving all over the place with a less than perfect VFO, to moving a little bit with rock-solid stability! Don't cut the VXO short for your next transmitter project. Look for a VXO 30 meter transmitter coming very soon next year. Next month we'll start on a station transmit control board. Also, we'll convert the Drake "B" and "C" series receivers for the WARC bands.

Until next month, everyone have a good holiday season, and see you next year, here in the "QRP" column. 73

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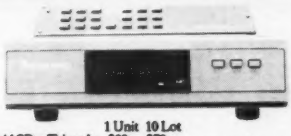

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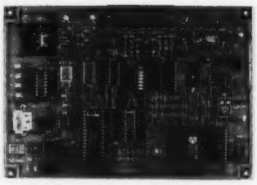

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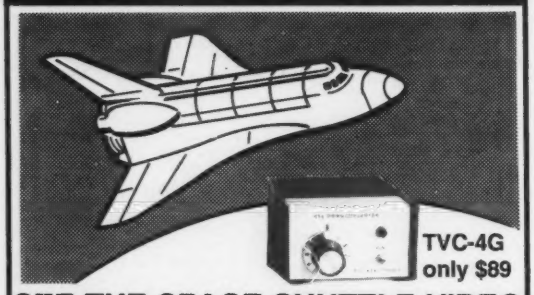

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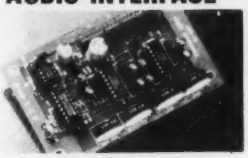

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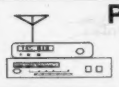

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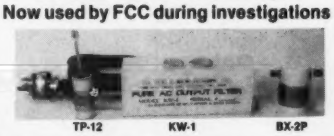

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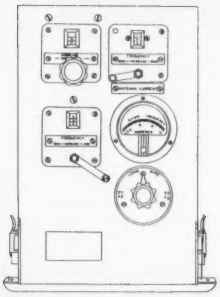

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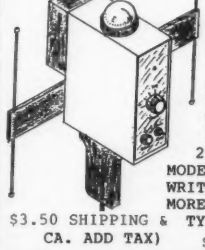

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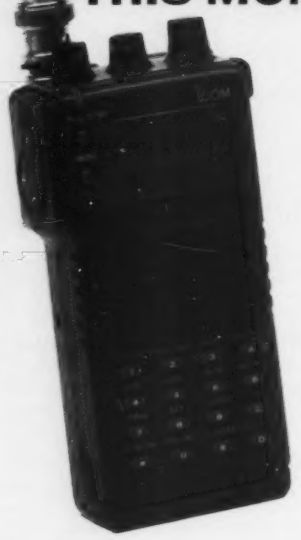

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Continued from p. 4

Now we're up to 14,275 and there's Glen Baxter K1MAN with his tapes that go on for what seems like hours, but he claims only last 45 minutes. Now he's bragging that he transmits his "bulletins" over 100 times a week. Oh, there, he's doing a commercial for *Radio Scan* magazine.

Above that, for the next 50 kHz, we find we're in the middle of what seems like a war. Hate, frustration, anger, bad language, jamming, more catcalls. Hey, this is a hobby?

So this is the best amateur radio has to offer, eh? This is their famous 20 meter band? Why, this is a sewer. This is disgusting! Why should some obviously deranged old men be permitted to waste such a valuable resource? What on earth is the matter with the FCC? How can they not close down this mess entirely and turn these incredibly valuable frequencies over to someone who has better use for them?

Well, let's give one more listen and see what we can find in between the DX pile-ups, the slow-scan porno and the total chaos above 14,275. Sure enough, there are some retired old men in there talking with each other. They're endlessly repeating their calls, a signal report, their "handle," a brief weather report, the make and model number of their transceiver and antenna, and a mention that sorry, they didn't get much of the last transmission due to QRM.

You know that in just a little over a year representatives of every country in the International Telecommunications Union will be meeting in Madrid to decide how to reshuffle the spectrum for better usage.

You also know that the Third World countries have little use for amateur radio. Few of the African hams are black. It's a white man's hobby... and most of the men who get on the air while visiting these countries ignore their laws, run illegal power, and even talk home via phone patches. Why should these countries be interested in giving up frequencies they need so a handful of old American men can waste them? Of what possible benefit is amateur radio to their country?

Your Job...

Let's see, as the ARRL president all you have to do is get amateur radio growing again, particularly by attracting youngsters; clean up the bad operating on our bands; and get the Third World countries to recognize how valuable amateur radio can be for them and thus protect our bands at the 1992 Madrid and 1993 Geneva WARCs. You're not going to do all this with something simple like a no-code license, that's for sure.

No, you're obviously going to have to mount a barrage of new programs. Worse, unless a bunch of new directors have been elected, you're probably going to have to fight around 13 directors for every program you want to initiate. On the other hand, you have some power at your command too. If you can get control of the Executive Committee you've got *QST* at your beck... and the IARU.

Now, the programs... it's going to take a bunch and you've got to get moving quickly.

Okay, first you'll have to get to work cleaning up our bands so we can be proud of them. We know the FCC doesn't want to get involved, so we're going to have to do this ourselves. Well, we're supposed to be self-policing anyway. We've always bragged to the FCC about this, so it's about time to live up to our billing.

One thing we do need from the FCC is a way to at least temporarily suspend the licenses of troublemakers... plus an immunity from legal harassment which might result. Could we make it a felony to sue over an amateur radio matter? I would prefer capital punishment, but I'd settle for a felony conviction.

The next move would be to set up a team at headquarters to organize the ARRL member clubs to get out there and bury the bad apples in suspensions.

The DX pileups can be cured, as I've mentioned before, just by limiting award credit to contacts made during contests. Once the DXCC and Honor Roll pressures are taken off, the pileups will blow away. This not only will clean up our bands enormously, it'll eventually result in us seeing thousands of hams getting on from rarer countries. This isn't going to hurt when the votes are counted at WARC.

Next we need to get back where we were 25 years ago and start attracting youngsters again. Hundreds of thousands of youngsters, not just the dozens we're getting now.

There's no easy fix on this like there is for cleaning up our bands. Here we need another HQ team, dedicated to promoting amateur radio growth. This means organizing every member club in the project. It means helping them understand the importance of public relations... of making amateur radio visible and getting across to kids that it's fun. No kid should be able to get out of the fifth grade without knowing about how neat ham radio is.

Clubs need to get a newsletter helping them organize community communications efforts... for parades, races, walkathons and so on. They need to be prodded to get radio clubs started in an "adopt-a-school" program. They need coverage in the local newspapers, on radio and TV.

It isn't going to be easy prying kids away from TV, but it can be done. We have a lot to offer kids, but as long as they've never even heard of amateur radio, we aren't going to get far.

We need videos that explain the fun we're having and how little it can cost to get started. They need to know about repeaters, fox hunting, OSCAR, packet, QRP, etc. We might start to class action libel suits against TV or movie producers who depict hams as nerds. Of course they might claim truth as a defense, playing tapes of our 20m band.

"Why should these countries be interested in giving up frequencies they need so a handful of old American men can waste them? Of what possible benefit is amateur radio to their country?"

But What About WARC?

There's never been an attempt to get ham ambassadors to visit the leaders of Third World countries and explain to them how amateur radio can benefit them and their countries. All it would take is a couple retired hams with some time and a few thousand dollars in travel expenses.

Heck, I went to Jordan and talked His Majesty King Hussein into setting up amateur radio. You're not going to find a stronger supporter of amateur radio today than Jordan. If I can do it, so can the ARRL... and they should.

You just talk money, that's all. Third World countries have to pay through the nose to import technicians to help set up, operate and service communications, electronics and computer systems. These techs can cost $500 to $1,000 a day vs. a few dollars if they had some of their own people. So put ham stations in the schools, provide a teacher, and soon you'll have hundreds... and then thousands of young amateurs, all anxious to learn because it's fun. It works. Heck, it'll even work here. It used to before the League wiped out our school radio clubs with their "incentive licensing" proposal 25 years ago.

Yes, there's a lot to be done... but it's all do-able if you have someone with guts and drive as president. That you? You're going to have to draw straight lines, even if they bisect a few balky old directors.

Similar Situation

In 1969, when I spotted FM and repeaters as a possible way to help get amateur radio growing again after five years of losing newcomers, I went at it every way I could. I set up my own repeater so I'd know what I was writing about. I published hundreds of articles on the subject. I organized repeater conferences around the country to get clubs to cooperate and standardize channels. I published a monthly repeater magazine and a flurry of books.

It worked! Within two years repeaters were the biggest ham activity in the country and I'd generated a new $100 million industry.

When I saw the potential for the microcomputer in 1975 I started one magazine after another, organized industry meetings to set standards, put on a huge microcomputer industry show in Boston, established one of the first mass produced software companies, started some software retail stores (ended up with a 58 Softwaire Centers chain), and so on.

Right now I'm tackling the music industry. It's dominated by a cartel of six international megacorporations (owned by Sony, Mitsubishi, etc.) and I want to break their hold over some 5,000 independent music companies. I've got a long list of projects I've formed or am forming to do this. Each has to be profitable, but the end goal is to sell more independent music.

Wait'll you see all the ways I'm promoting the sale of indie music... via samplers in hotels, dance studios, restaurants, book stores, hi-fi stores, discount stores, etc. I've already started releasing samplers and I'm gearing up to crank out up to a dozen a month!

Then there's my international talent hunt, looking for undiscovered performers who should be recorded... and will be on indie labels.

If you were to take over as president of the ARRL you'd be faced with one heck of a job, just as I was. But it would be a challenge and fun, just as it was for me. You have the tools you need to make it happen, all you have to do is organize and manage the many efforts it's going to take.

You'll be talking with the FCC Commissioners and selling them on what you want to do. That won't be hard because you'll be solving many problems for them... and helping to cut not only their aggravation, but saving them money. Further, by attracting youngsters to our hobby, you'll be laying the groundwork for a much stronger America in a few years. That Information Age stuff isn't hype; it's where the money is right now and where it's going to be even more concentrated in the future.

You'll have to get out and visit some Third World leaders to get this program started. It'll take a selling job, but you have so much to offer you aren't going to get many turndowns.

You're going to be the keynote speaker at every major hamfest and convention, whipping up excitement and cooperation. You're going to make videos to help sell member clubs on cooperating. You're going to have to find some good ham writers and set

them to turning out the needed support publications.

You're going to have to cultivate an atmosphere of cooperation at HQ. It isn't going to be easy, but you aren't going to get much done if everyone is tied up with internal politics . . . and afraid to say anything.

You're going to have to work with the *QST* editors to get the covers into the '90s and out of the '50s. Then you can put *QST* on the newsstands so it can help attract newcomers. I'd even plan on starting a newcomer's magazine, once the dam has been broken and we start seeing new blood.

Using determination and creativity, the president of the ARRL can change America's role in the next century, helping to get back our consumer electronic industries, reviving our research labs. The alternative is the gradual death of amateur radio in America.

Japan understands how critically important amateur radio is to their success in electronics manufacturing and research and how it's the powerhouse behind their financial power. This is the power that's made it possible for them to buy more and more of our entertainment industry.

Oh, You Don't Agree?

On what point don't you agree? Do you disagree that our bands need cleaning up? How about our need for growth? Our ham industry is down to 25% of what it was 25 years ago. You disagree that we need to attract youngsters? Or maybe that we can?

How about WARC? Heck, if you're an ARRL member you got a letter asking for money, citing a long list of the problems we face in Madrid in 1992. I think you're a sucker if you sent money. Many true believers will, no doubt.

I didn't bring up getting the National Traffic System onto packet instead of chugging along at around 10 wpm on CW. I didn't suggest organizing teams to be sent to emergency areas to set up communications centers . . . like in Saudi Arabia to handle welfare traffic for our military who are sitting in the hot sun with little to do.

How about sending teams to Jordan, Egypt and India to handle traffic for the thousands of refugees streaming into Jordan from Iraq?

When St. Lucia was devastated by a hurricane I sent *73* staffer Tim Daniel N8RK down with several trunks of ham gear. It helped to tide them over and we got a very nice commendation from the island governor. So where are the ARRL emergency teams when they're needed? Heck, even K1MAN and his blithering has been able to do better than the ARRL in helping with emergencies. Far better.

If you were president of the League, wouldn't you have a ball getting amateur radio going again? I know I would. But it's going to take guts, creativity, and world-class problem solving skills. It'll be fun, if you take it on. 73

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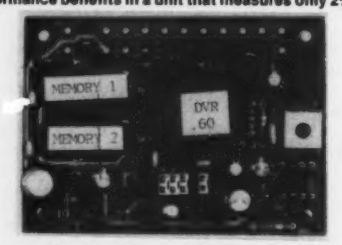

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ATV

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Bill Brown WB8ELK
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Hancock NH 03449

The Mt. Washington DXpedition

On August 4, a group of enterprising hams ascended to the top of Mt. Washington, New Hampshire, to hook up the 146.655 repeater and to try for some real ATV DX. This 6,288-foot peak is the highest point in New England and provides 2 meter coverage from as far as Albany, New York, to the mid coast of Maine. It's also the home of the worst recorded weather in the world! Winds exceeding 238 mph have been recorded (just before the anemometer broke!).... Even on a hot summer's day it can be downright bone-chilling on the summit.

Mike WA1PTC drove his ATV-filled van up to the top, Cal WA1WOK brought along N1KK's 10 watt ATV station and headed up the mountain along with Mike N1CGF, Chan KA1OU and Vern N1CKX. Situated on top of the weather observatory, they installed the beam and hooked up their 10 watt ATV transmitter to provide New England with an afternoon of excellent video. They knew they were in a good spot when the first signal received was a P4 picture from the KA1AFE ATV repeater in N. Andover, Massachusetts, nearly 100 miles to the south.

Photo A. Working Mt. Washington from Monhegan Island, Maine. From left to right, Adam and Evan Cooke holding the portable ATV package.

Meanwhile, somewhere off the coast of Maine...I hauled my portable ATV station out to Monhegan Island. Situated 10 miles off the coast, the view from the base of the lighthouse provided a line-of-sight path to Mt. Washington (100 miles to the west). On a clear day you can actually see the peak's silhouette just after sunset. Assisted by Bob KC1MC, along with helpers Adam and Evan Cooke, we hauled everything up to the top of Lighthouse Hill.

After setting up, we gave the crew on Mt. Washington a call and got an immediate full-scale reply on 2 meters! Mike WA1PTC pointed the beam our way and provided us a bird's-eye view of the visitor's center with a P4 full-color picture complete with great subcarrier audio. My receive setup consisted of nothing more than a stock Radio Shack Pocketvision™ 23 LCD TV with its onboard whip antenna! Visitors to the lighthouse museum on the island were amazed to see the live pictures of the cog railway chugging up the side of Mt. Washington, complete with its whistle blowing.

We were also able to send a P2 picture up to the mountain with just 1 watt to a vertical ¼-wave whip. Jon WA2YVL in Freeport exchanged two-way P5 pictures with the Mt. Washington crew as well as with our station on Monhegan Island.

Tugboat TV

Jon WA2YVL is the captain of a large ocean-going tugboat. Every two weeks he heads out on a two-week journey up and down the Eastern Seaboard with a large barge in tow. On October 4 he set sail from Providence heading towards Delaware. He brought along a 1 watt ATV station and transmitted a signal on 426.25 MHz in hopes of stirring up some activity. His antenna is mounted 90 feet above the water on a mast above the bridge. Bob WA1WVJ from West Haven, Connecticut, first saw him on the morning of October 5. Even though the tugboat was over 70 miles to his scuth, and shooting over a good part of Long Island, he was P3 to P4. The tugboat signal was even able to access the W1NRE ATV repeater in West Haven as well. A few days later on the return trip from Delaware, Jon was rewarded with successful ATV contacts at distances up to 100 miles away thanks to a band opening. John WA1IAO in northern Connecticut received a P2 picture at times, Dave WA1UQC and Fran N1GAU both received the signal near the Hartford area. WA1WVJ started receiving the tugboat transmission at 9 a.m. and could see him all day long as the boat travelled up to Block Island, over 50 miles away.

Photo B. Bill WB8ELK receives the Mt. Washington signal with his portable LCD TV (Monhegan Island).

Jon plans to add a live camera to his station on the next couple of trips and may be covering different areas of the East Coast, possibly as far north as Portland, Maine. Anyone seeing his signal should give him a call on 144.34 MHz. If you'd like to find out his schedule, drop him a line via packet radio. His packet address is WA2YVL @ K1RQG.ME. Also, we will announce his schedule and location during the weekly ATV net on 3.871 MHz at 8 p.m. eastern time.

You never know just where Jon will end up in his journeys up and down the coast. At the time of this writing he's in New Haven harbor having a great time working W2WOD, KB2BUA, WA2FNQ and KA1DBS.

Since band enhancements occur somewhat frequently along the seacoast, Jon thinks it may be possible to work stations from Maine to South Carolina with a good opening from his seafaring vantage point. If anyone sees the tugboat signal, you can QSL to Captain Jon Andrews WA2YVL, P.O. Box 357, So. Freeport, ME 04078–0357.

Photo C. Tugboat ATV.

Photo D. Jon WA2YVL at the helm of the ATV tugboat.

73 INTERNATIONAL

Arnie Johnson N1BAC
103 Old Homestead Hwy.
N. Swanzey, NH 03431

Notes from FN42

Winter in New England is upon us again. We have moved past a very beautiful fall foliage season with leaves in shades of red, gold, brown, yellow, and orange. Those of you who have not seen New England in October should try to visit then.

You can enjoy a late afternoon and night on Friday, and a whole day on Saturday, at the Hosstraders Ham Fleamarket at the Deerfield Fairgrounds in Deerfield, New Hampshire. The fall date has stabilized on the first Saturday in October, and the Spring Edition is the first Saturday in May. It is said that the best deals happen on Friday night.

You can also enjoy the New England ARRL Conference and ham fleamarket at Boxboro, Massachusetts, the second weekend in October. This year the weather was wonderful at Deerfield, but Boxboro was deluged by rain from the remnants of two hurricanes.

At Deerfield, I had the great pleasure of meeting our Hambassador from Kenya. Imagine my surprise when I looked up from my selling table and saw a name tag with Rod 5Z4BH on it! Rod Hallen was back in the United States for a conference. He had heard about a "small ham flea market" and he decided to attend. There were over 5,000 paid admissions. The entire proceeds went to the Shrine Hospital Burn Clinic in Boston.

Rod and I had a very nice chat, and he informed me that he has extended his stay in Kenya for one more year so we will have the pleasure of his informative observations and news from Kenya for another year. "It's a small world, Part II," took place at the same table when one of the hams I was selling with, Dave N2GE, came over and reintroduced himself to Rod. Dave had been in Kenya during the summer and had met Rod at the embassy. Unfortunately, this was the one day I didn't take my camera with me, so I couldn't get a picture of Rod for this column.

I have had a very rewarding and satisfying year with 73 Amateur Radio Today and "73 International." The news from our Hambassadors has been timely and interesting. But we've lost a few of our past Hambassadors along the way. I feel this is an appropriate time to recognize those who have contributed so much during the past year, and make a plea to our readers for volunteers to increase our staff of Hambassadors.

If you do not see your country represented in the following list of Hambassadors and wish to volunteer, please drop me a note at the address above or the address of the magazine. You can also reach me through the 73 BBS. (See the "Table of Contents" page.)

Your written skills in English do not need to be perfect. That's what I am here for. But I am not perfect, either, so that is why Wayne hired wonderful people like Linda, Hope, and Joyce, to keep the rest of us straight. Don't be afraid. WE NEED YOU!

You will never get rich in the publishing business (ask Wayne), especially by becoming a Hambassador. The pay is a ***FREE*** *airmail subscription to 73 Amateur Radio Today as long as you submit timely information three to four times a year. The rewards are seeing your name in print AND knowing that the rest of the world is made aware of the newsworthy ham events happening in your country.*

As a matter of fact, I just received a letter from a ham in Bulgaria who wishes to become a part of 73 Magazine. Keep an eye out for offerings from Milen Postadshieff LZ2MP. His address appears in this column for those who wish to communicate with him.

This is a holy time for many religions, and it's the end of the present year and the beginning of a new year. I am sure that I can speak for our 73 Hambassadors when I pass to all the best of wishes for the holy season and the coming new year. May there be peace and prosperity to all, and may all hams in all nations make the world a better place to live.

And now, the list of 73 Hambassadors who have submitted information during 1990.—Arnie, N1BAC 73

Australia
Ken Gott VK3AJU
38A Lansdowne Road
St. Kilda, Victoria 3183
Australia
"Silent Key"

Brazil
Carlos Vianna Carneiro PY1CC
Afonso Pena, 49/701
20270 Rio de Janeiro
Brazil

Bulgaria
Milen Postadshieff LZ2MP
PO Box 237
7000 Russe
Bulgaria

Cyprus
Aris Kaponides 5B4JE
PO Box 1723
Limassol
Cyprus

Hong Kong
Phil Weaver VS6CT
Flat 39C Two Park Towers
1 Kings Road
Hong Kong

Israel
Ron Gang 4X1MK
Kibbutz Urim
D.N. Hanagev 85530
Israel

Kenya
Rod Hallen 5Z4BH
Box 55
APO New York 09675

Republic of Korea
Byong-joo Cho HL5AP
PO Box 4, Haeundae
Pusan 612-600
Republic of Korea

Liberia
Mahmoud Idera-Abdullah EL2CE
PO Box 20-4262
1000 Monrovia 20
Liberia, West Africa

Lithuania
Jonas Paskauskas LY2ZZ
PO Box 71
Siauliai, 235400
Lithuania

Mozambique
Phil Gray KA7TWQ
c/o CARE, C.P. 4657
Maputo
Mozambique

New Zealand
Des Chapman ZL2VR
459 Kennedy Road
Napier
New Zealand

South Africa
Peter Strauss ZS6ET
PO Box 35461
Northcliff ZA-2115
Republic of South Africa
"Silent Key"

Spain
Woodson Gannaway N5KVB/EA
Apartado 11
35450 Santa Maria de Guia
(Las Palmas de Gran Canaria)
Islas Canarias, Spain

Sweden
Rune Wande SMØCOP
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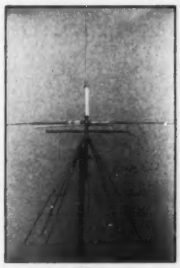

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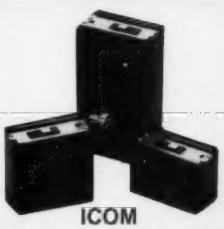

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The Colvins

Lloyd and Iris Colvin, W6KG and W6QL respectively, are on the DXpedition trail again. The first two operations of this six-month DXpedition, they signed 5H0QL and 7Q7KG. They usually remain at each location for three or four weeks. They'll return home in March. Contacts with the Colvins count for the YASME Award. For all of their operations, QSL via YASME, P.O. Box 2025, Castro Valley CA 94546.

VP8WW and XU1DX—Pirates?

There is considerable doubt that the September operation by VP8WW was legitimate. The operator gave his location as South Georgia and said to QSL via G3HWW. G3HWW is the callsign of the York Amateur Radio Society, and the secretary of the society knows nothing about VP8WW! Thanks *DX News Sheet* et al.

JA1NUT notes that the recent operation by XU1DX was not legitimate. The only operator currently active from Kampuchea/Cambodia is Sokun, who operates XU8DX. She is not proficient at CW and seldom operates the mode.

CE0 San Felix

Weak rumors mention the possibility that one of the members of the military garrison may be an amateur radio operator, with expected arrival around January 1, 1991.

Leningrad International Hamvention

Plans for next year's convention in Leningrad, to be held the first week in August 1991, are underway. Further details may be obtained by writing to Amateur Radio Center Inter-Radio, P.O. Box 73, Leningrad 196070, USSR.

QSL Notes

T30BC. ZL2QW is not the QSL manager for Henry T30BC. She has not received logs from Henry since April. The new manager is K7EHI.

QSL manager WN5K, due to sickness in the family, is no longer the QSL manager for *YS1OD, YS1MAE, VP5LJ, VP5DG, VP5HG, VP5HL* and *VP5JD*. The last six stations will find stateside managers, but cards for *YS1OD* should be mailed to the *Callbook* address. Thanks WN5K.

HS0B, HS0M, HS0SM and *HS0AC* QSL cards now go to NY2E. Note that NY2E has a new address: Ray Fliker, 433 Palo Alto Drive, Palm Springs FL 33461. WA4BCQ is ill and can no longer handle these cards. Thanks NY2E.

KC4AAA Antarctica. Bob NC6J has informed the ARRL that he can only confirm contacts for this station for the period August 1988 through October 1989. The new support group operating there now won't send him the logs. Bob suggests the following QSL route: Antarctic Support Assoc., 61 Inverness Drive East, Suite 300, Englewood CO 80112. Thanks NJ1Q of the ARRL.

7Z1AB Saudi Arabia. There are several QSL routes for the American Embassy station in Saudi Arabia. For operators Rick (N6TRE), Dirk (WB3ZIZ) and Dau (DL7ALC) QSL via WB2WOW. Cards for operator Don KS9F go to WA1S.

XU8DX. JA1NUT can only confirm contacts made after April 19, 1990. Contacts made with YL Sokum made before that date should be sent to F2YS/W2. 73

QSL Routes

1Z9ØCW	A pirate! Don't QSL via KA6V/7.
4K4QQ	via RA1QQ's 1990 *Callbook* address
4K4/UA6WCG	via I8YRK
4U1ITU	circa Sept. 11, 1990: USA via AA6MC; Europe via GØMFO
5HØQL	via YASME (see 7Q7KG)
5T5HH	H. Hourton, Box 1172, Nouakchott, Mauritania
5V7SA	RTTY via KB8BS; other via WB4LFM
7P8EN/P	via ZS5BK
7Q7KG	YASME, P.O. Box 2025, Castro Valley VA 94546
7Q7XB	via LA7XB
7Z1AB	For operators Rick (N6TRE), Dirk (WB3ZIZ) and Dau (DL7ALC) via WB2WOW. For operator Don (KS9F) QSL via WA1S.
8P9HR	via K4BAI
8R1/W1CDC	via AB1U
9H1XX	via DL2GBT
9H3CT	via VS6CT
9J2AL	Should be QRT. QSL via bureau ONLY, to WDØHHM.
9N1NFO	via WB4NFO
9Q5PL	Peter Laschan, Koernerstr 13, A-6020 Innsbruck, Austria
A35KB	Box 1, Nuku'alofa, Tonga
AI5P/WJ4	via AI5P
AY9F	via LU6FHF
BY4RSA	Box 538, Nanking, People's Republic of China
C3ØCAG	Willy Petit, Rue Jules Valles, BT E No. 1 F-76920 Amfreville La Mi Voie, France
CR1BI	via CT1CQK
ED1ISI	via EA1ANE
ED5IPE	via EA5GEO
F2JD/CE7	via F6AJA
FP/VE1DXX	via VE1AL
FR5CN	via FR4CN
FWØDD & FWØET	Sam Torope, Box 3040, Noumea, New Caledonia
GØGWA/	via GØGWA
G4WYG/ST4	via G4OHX
GB5ØBOB	To GØKUC via RSGB bureau
GXØANT	via G4XTA
GS6UW/P	via G3ZAY
GX6UW	via G4BAH
HL3ØAP	via HL5AP
HSØE	via K9EL
J2ØX	via F2VX
J73BM	Marcus Bristol, Box 245, Dominica
JT7ØSH	P.O. Box 1127, Ulan Bator, Mongolia
JWØGB	via WB4ZBI
KBØFUE/DU3	PSC 5, Box 10558, APO San Francisco CA 96410 USA
KC8CW	via JA2NQG
KC6DX	JH2BNL, Yuji Wada, P.O. Box 73, Sekishi 431-31, Japan
KC6EE	via LA1EE
KC6GV	via LA2GV
KH2I/KHØ	via JK1KRS
LX2PA	via PA3DKC
LZ5M	via LZ1RU
LZ5Z	via LZ1KDP
N6BUV/KHØ	via WD6DNE
OD5YU	Box 8, Tripoli 604, Lebanon
OHØBT	via DL4DBR
OH2AQ/OJØ	via OH2BVF
ON4USA/P	via ON5PL
OY3QN	via OZ1ACB
P29NEP	Nathan, P.O. Box 789, East Highlands Province, PNG
P29SC	via WB1GWB
PAØGAM/ST2	via PAØGIN
PA3FAC/SU	via PA3FAC
PJ6/WS4E	via WS4E
PY1QN/PVØ	via PY1QN
RØAJ	via UZØJWA
R1SO	via RA3YF (see this issue)
RA3YF	Vladimir Scherbakov, Box 27. 241000 Brynsk, USSR
RLØP/KA6ZYF	P.O. Box 1489, Santa Monica CA 90406-1489
RQ9W	via UQ1GWW
RY1B/UW3SG	P.O. Box 1161, 460051 Orenburg, USSR
S79NBD	via JG1NBD
SO3HRA	via DJØIF
STØYD	via F6AJA
ST2YD	via F6AJA
SVØHS	via DJ8MT
T32HK	via JL3UIX
TM1BRE	(CW) via FB1MUX; (SSB) via F6GMB
TO8ONR	via F6ELE
TR8RY	via FF6KGU
TU2UI	via WA8ZWR
UØW/KA6ZYF	see RLØP/KA6ZYF
UØW/W6/G3MHV	see RLØP/KA6ZYF
UA6U/VE6JO	via VE6JO
UL7P/G3MHV	see RLØP/KA6ZYF
UM8QDX	Box 1, Kadzhi-Sai 722452, Kirghiz, USSR
UW2F	via UA2FM
UW4HM/RL4L	Box 8267, Kuibyshev 4443067, USSR
V31BB	via Gordon Silverman, N3ADC, 77 Homestead Road, Levittown PA 19056-1349
V47NXX	via KB2XR
V51BI	via DF2AL
V63AN	via JA2NQG
V63AR	via JA2BNL (see KC6DX)
V73BL	via WB4CSK
VP2V/N5XX	via N5XX
VP5VAA	via WS4E
VQ9TB	Tom Benton, P.O. Box 55, FPO San Francisco CA 96685 USA
WA8ZNM/HH2	Alvin Blevins, 8090 15th St. E., Sarasota FL 34243
WB4CSK/KH6	via WB4CSK
XE2XSQ	via K5TSQ
XX9XJ	Two routes mentioned: K6JJ and K6JJE; neither call is in the 1990 *Callbook*.
Y9ØANT	via Y21RO
YEØK	P.O. Box 77, JKWB, Jakarta 10270, Indonesia
YJØAMH	via KF7PG
YN1CC	José says via Box 2971, Managua, but W3HNK says via W3HNK
YS1HUKE	via N8FU
ZD8S	via AKØM
ZD8Z	via W6CF
ZF2NE/ZF8	via W5ASP
ZF2PM	via NE4L
ZF2PN	via NE4L
ZM7AMO	via ZL1AMO
ZS6ØPTA	via ZS6TB
ZWØJR	via PP5JR
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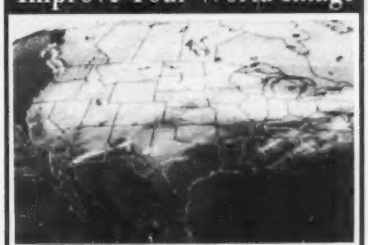

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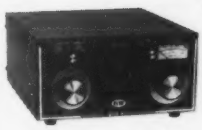

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Packet via Satellites

Packet via amateur satellites has been around since the early days of packet radio activity. Even before the first ARRL Amateur Radio Computer Networking Convention in 1981 at the National Bureau of Standards in Gaithersburg, Maryland, AMSAT earmarked Special Service Channels (SSCs) for packet communications on future high-orbit satellites. Dr. Hank Magnuski KA6M, designer of one of the first packet digipeaters, was in charge of setting standards for SSC use. This came at a time when AMSAT was still recovering from the loss of Phase 3 A, which was to have been the first high-orbit, long-life hamsat. Phase 3 A met a watery end when its Ariane launcher failed to achieve orbit in early 1980.

Packet operation through analog satellite transponders is comparable to direct user-to-user packet procedure. Early tests were made at 1200 baud, but activity at 300 baud using HF modems was more reliable due to the weak-signal nature of satellite communications at the time. The use of the analog transponder space for packet experiments was never popular, though. The store-and-forward potential of the AX.25 protocol was not addressed via the transponder medium. A digipeater in space, or some other digital mailbox system for handling packets, was needed.

Determining the Standards

At the 1983 ARRL Amateur Radio Computer Networking Convention in San Francisco, California, Phil Karn KA9Q presented the paper, "Modulation and Access Techniques for PACSAT," and Don Connors KD2S presented "The PACSAT Project." Don's paper described the design goal of "total global access by all hams to a store-and-forward packet message handler" via satellite systems. He explained the need for packet satellites and described the on-board systems and technical parameters for all satellite subsystems.

Phil's paper on modulation techniques, when viewed with Don's, laid down the blueprint of today's Microsats from frequency choices to modulation methods. It was obvious that a form of phase-shift keying (PSK) would work better than standard audio-frequency-shift keying (AFSK) on an FM carrier for packet-satellite downlinks, and that is what we have today.

AFSK-FM has advantages that include low cost, simplicity, and easy Doppler tracking, but it has some serious disadvantages. These include inefficient bandwidth use and poor noise performance.

The UoSAT-OSCAR-11 FM downlink requires 15 kHz to support a 1200 baud signal, while a PSK signal with the same bandwidth could easily carry 9600 baud. AFSK-FM exhibits a sharp noise threshold at a relatively high carrier-to-noise ratio. Problems with impulse noise are also evident. Anyone who has been active with VHF packet has noticed that even strong signals are difficult to copy when powerline and auto ignition noise get into the received signal.

Other concerns with satellite downlinks include fading and polarization losses due to spacecraft rotation and orientation with respect to the ground observer.

The DCE Experiment

In 1984 when U-O-11 went to orbit, it carried the Digital Communications Experiment (DCE) which provided a proof-of-concept testbed for PACSAT work. The experiment continues to act as a mailbox in orbit to test digital communication software and provide data on hardware survivability, current consumption, and operational behavior in space. Only a small number of hams around the world are active as gateway stations through the DCE, but others can route their messages to these gateways for uplinking to U-O-11. Messages can sometimes be seen between telemetry frames on the 145.825 MHz FM downlink at 1200 baud.

When Fuji-OSCAR-12 was launched in August 1986, hams had their first opportunity to find out what PACSATs were all about. Whenever the mode "J" (2 meters up and 70cm down) digital transponder was active, stations could access the mailbox and leave messages for hams on the other side of the world. Signals were good, but battery problems made continuous activity impossible. After only a day or two the system needed recharging, with corresponding down periods and loss of all the messages in memory. Even with these problems, the open mailbox was an exciting packet experience.

Fuji-OSCAR-20, launched in February of this year, is experiencing similar difficulties, but this time they are related to temperature problems. The satellite is too hot. High current consumers like the digital system must be shut off for long periods to keep the internal temperature at a reasonable level to avoid serious battery damage. Schedule announcements from the JARL (Japanese ARRL counterpart) have provided some relief to those stations listening for the satellite.

Today's Packet Satellites

In January 1990, an Ariane-4 rocket placed four AMSAT-built Microsats into a nearly perfect sun-synchronous orbit at 800 km. The satellites, nine inches on a side, all carry similar payloads of packet and scientific experiments. All of this group of Microsats have store-and-forward capability, with two of the four carrying packet communications as their primary payloads. The other two are for more educational purposes and include a charge-coupled-device (CCD) camera for Earth imaging and a digital speech synthesizer.

In addition to the packet communications systems, the Microsats incorporate highly efficient solar panels, innovative power supply designs, VHF and UHF transmitters with DC to RF efficiencies as high as 76 percent, and computers using 1.3 micron surface-mount technology (SMT) devices with 8 megabytes of memory that use only about half a watt. All of this (batteries included) goes into a nine-inch cube weighing less than 22 pounds.

The packet systems are primary to AMSAT-OSCAR-16 and LUSAT OSCAR-19. They each have five uplink receivers and two downlink transmitters. While all receivers are on simultaneously, only one transmitter per satellite is usually active for packet downlinking. A complete frequency chart of uplinks and downlinks can be found in the May 1990 "Hamsats."

Photo. WEBERSAT's view of the sun. Taken on 8/15/90 at 0508 UTC. Photo courtesy of Weber State College.

While the objectives of DOVE-OSCAR-17 and Weber-OSCAR-18 differ from the store-and-forward objectives of the other two satellites, they offer exciting possibilities to those with educational interests.

Microsats are small and light because it costs 16 times more per pound for AMSAT to get their payloads into orbit now than it did five years ago. A $20,000 satellite launch in 1985 would cost $320,000 today. Interest in the Microsat or lightsat concept has heightened in recent years. As the world becomes aware of the potential of the small or "micro" satellite, AMSAT finds itself competing for launch space once filled with ballast and nearly free for the asking.

Just after the launch of the Microsats, a background paper for Congress became available. Entitled "Affordable Spacecraft: Design and Launch Alternatives," it covered several different ideas on satellite construction from "lightsats" to "fatsats" and from simple devices to highly complex and compact designs. You can order a copy from the Superintendent of Documents, Government Printing Office, Washington, DC 20402-9325, for $2.25, shipping included. Ask for GPO stock number 052-003-01174-3.

Easy Packets from Space

D-O-17 transmits standard packet using AFSK-FM on 145.825 MHz. It is the perfect place to get started with satellite packet activity. Typical power levels from the satellite provide a 10 dB improvement over U-O-11 signals and can be heard on almost any antenna. Anyone who is currently active on VHF packet can hear the signals and see the resulting raw telemetry and messages on their CRT or other display device.

For those who can capture the data to disk, programs are available to decode the data and display information on the satellite's activities and health. One program found on many bulletin boards is NK6KTLM. It is usually listed as NK6KTLM.ARC (for archived). After "un-arc'ing" the file, the "readme" document explains how to activate the easy-to-use program. Fifty-seven channels of data can be decoded and examined with this program.

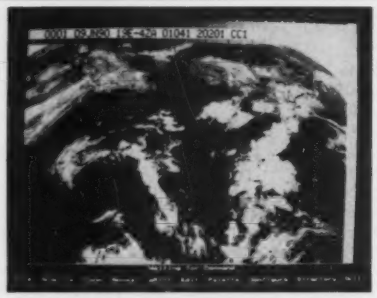
Picture Packets from Space

W-O-18 takes snapshots of the Earth near the equatorial regions and sends them to Earth in packet form on 70cm.

The picture information is stored on the satellite in digital form and sent on one of the 70cm PSK transmitters. It's not sent pixel-by-pixel; two good passes are needed to collect a complete image. On one pass, odd-numbered lines are sent, and on the next pass, the even-numbered lines. When data from two subsequent passes are received and merged, a complete image can be put together. Any gaps that occur can be filled with values from adjoining pixels to make a clean picture.

Each day the satellite typically sends data for one picture, allowing Earth stations four to six opportunities to collect enough data to build a complete picture.

To capture and display the images, you need a PSK modem in conjunction with a standard packet terminal node



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controller (TNC). Several modems have been described in recent "Hamsat" columns. They include the G3RUH unit available in kit form from Radiokit, the TAPR kit from the Tucson Amateur Packet Radio Corporation, the PacComm Microsat PSK modem from PacComm, the DSP-12 Multimode controller from L.L. Grace, and the Microsat Demodulator as described by W6OIJ in the September 1990 issue of *QEX*. A receive system capable of operation at 437 MHz SSB with digital frequency control from the PSK modem is needed. Finally, to complete the system, you need an antenna (omni is fine), a PC compatible computer with EGA or VGA graphics, and appropriate software.

The most commonly used data-collection software is TLMDC version 3 by N4HY. Like NK6KTLM for DOVE decoding, you can find it on many BBSs.

First the TNC is put in the KISS mode by sending it the command KISS ON followed by RESTART. Then TLMDC is run according to its "readme" document. Normal data and messages are displayed on the screen while a raw-data file is collected and stored by the program during the course of a pass. Upon exiting the program, a second program is needed to read the raw-data file and display the results.

WEBERWARE 1.0 from Weber State University is available from AMSAT and is currently the best system for picture display and manipulation. This collection of programs allows the user to change parameters of the viewed image, merge in other passes of the same picture, fill mixed pixels, print the results in black-and-white, or colorize the scene according to color-burst information sent with the picture file from the satellite. To get the TNC back to normal operation, it may be necessary to give it a hardware reset by turning it off and disconnecting the back-up battery.

W-O-18 is also capable of receiving and storing an image from Earth. It has a 1265 MHz receiver for standard amateur television (ATV) reception. On commands from the control station in Ogden, Utah, it can take a snapshot of a picture sent from an Earth station and retransmit it via the packet system. Early experiments with this scheme have demonstrated that very high-power or high-gain antennas on the ground are needed for picture uploads.

SAREX 2 Update

NASA officials were forced to scrub the launch of STS-35 on September 11, 1990 due to another hydrogen leak in the rear engine compartment. The next opportunity for *Columbia* and the Shuttle Amateur Radio Experiment is in early December. AMSAT will once again publicize the frequency plans and schedule information for the mission as the launch approaches. Check the May 1990 issue of *73* for background information.

Number 18 on your Feedback card

UPDATES

DXDA Corrections

See the October '90 issue, page 80. Saipan and Rota Island should both be **KH0**, not KH2. These are the only two corrections. Mariana Island and Tinian, also **KH0**, are correct as listed. Guam is correctly listed as KH2. *TNX Paul Swartzendruber K4EQY in KH0-land for calling us.*

ROBO-COPY

See the above article in the Oct. '90 issue, page 28. Mike Hansen WB9DYI: "Thanks to input from readers, I've verified that there are two errors in the pin selection/software version for the signal input to ROBO-COPY. These errors affect SOME but not all pin selection/software combinations. If you are not getting any response from ROBO-COPY once the main screen appears, one of the following fixes should cure the problem.

"For software downloaded from the *73* BBS prior to October 16: The version of the software labeled ROBO.EXE uses the 'DCD' (data carrier detect) signal for input, *NOT the 'RI' (ring indicator) as stated in the article.*

"FIX 1: Move the signal input from the 'RI' pin to 'DCD.' The correct signal input pin for the ROBO.EXE version is pin 1 on a DB9 connector and pin 8 on a DB25.

"FIX 2: Download the updated software version ROBO2.EXE from the *73* BBS. Check to make sure that the signal pin is indeed 'RI.' The 'RI' pin is number 9 on a DB9 and pin 22 on a DB25. *Note that 'RI' for the DB25 type connector is stated incorrectly in the article.* The DB9 pin number is listed correctly. There are no other differences between ROBO.EXE and ROBO2.EXE except the pin selection changes.

"For software received directly from WB9DYI: The only software version sent through the mail is ROBO2.EXE, even though it is labeled ROBO.EXE. You may want to rename your copy to match the new name. Check to make sure that the signal pin is indeed 'RI.'

"I'm sorry for this mix-up. I changed computers during the final stages of the ROBO-COPY check out and must have archived the wrong version of the software." *TNX WB9DYI.*

New Kenwood Warranty

Kenwood announces a new warranty program for all new amateur radio products purchased in the United States. Effective October 1, 1990, all new Kenwood transceivers, receivers, accessories, and options carry a full one-year warranty from the date of purchase.

New warranty cards are being issued for existing dealer stock, but they may not be available initially. A sales receipt dated on or after October 1, 1990, is the only documentation necessary for warranty claims. Additional information is available by mail from Kenwood USA Corporation, Amateur Radio Customer Service, P.O. Box 22745, Long Beach CA 90801; by phone at (213) 761-7140; or via the Kenwood BBS at (213) 761-8284 (2400 baud max, 8 bits, no parity, 1 stop bit). Add this new warranty info to the Kenwood service article by WB6NOA in the April '90 issue. *TNX, Kenwood, for the bulletin.*

Goof-Proof Goof

See "Goof-Proof Regenerative Receiver" in the Nov. '90 issue, page 35, Figure 4. The parts placement should indicate **Headphones** (if using the headphones-only option—in which case you don't need to build the LM386 audio amp section) where it shows Audio output. The 8 ohm speaker is attached where it shows **SPK**. . . de WB8ELK.

NANDs, not ANDs

See "TTL Transceiver for 40 Meters" in the Nov. '90 issue, page 30. Look at the "IC Layout" in the upper left corner of Figure 1. The little circles were left off the top of the symbol describing the type of gate, rendering them AND gates when they should be NAND gates. See the proper symbol in the figure. *TNX KB1UM for catching this.*

Figure. The little circle on top signifies that the gate is a NAND gate.

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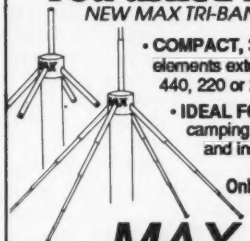

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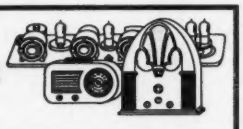

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David Cassidy N1GPH

Magic

My generation (thirtysomething) is the last generation that will be amazed by radio. The fact that I can sit in my bedroom and talk to some other person sitting in their bedroom on the other side of the globe still fills me with wonder. That, in a nutshell, is why I became a radio amateur. To this day, I still have a childlike feeling of awe every time I turn on a transceiver. Oh, I know *why* the whole thing works and I even have a pretty good grasp on *how* the whole thing works. I don't care about Marconi, the ARRL study guides or the FCC exam. I know that radio is magic!

Kids today grow up with magic. It has become commonplace. They have dozens of channels of cable TV piped right into their homes with no interference. They learn about computers before they learn to read. They don't realize that a computer is magic. They have never known a time when ordinary men and women didn't climb to the top of tall rockets and travel into space. It wasn't so long ago that a space launch was an international event. Now, the major networks don't even provide live coverage for space shuttle launches. Space travel is magic, and they don't even know it. And what about communication satellites? In a world where I can sit in my car (my *car!*) and talk to anyone, anywhere in the world on a telephone, what is the big deal about a bunch of old men sitting in their ham shacks? Radio is low tech. Even packet is a dinosaur when you compare it to what your average twelve-year-old can do with a Commodore 64 and a modem.

I feel sorry for today's kids because they don't have that magic. Even though I grew up in the age of television, it is personal communications by radio that has always fascinated me (what is television, after all, but radio with pictures?). I still remember vividly, as I'm sure most of you do, the first time I sat alone behind the key of a code rig and sent my own callsign. Somewhere in Texas another person sat by his code key and returned my CQ. There it was! My own callsign, coming over the speaker—coming out of thin air. It was magic.

I think kids today have lost that sense of magic. Sure, they can recreate the experience that most of us had—sitting behind a radio that glows in the dark, the smell of warm dust on the tubes, listening for that faint CQ. They can buy the old rigs and have a ball with them, but I don't think they have the same sense of amazement many of us experienced. Modern transceivers are great. They have all kinds of bells and whistles that we only dreamed of ten years ago. But still, don't you sometimes wish you had a radio the size of a Volkswagen sitting on your desk—all dials and knobs and meters—just sitting there, waiting for you to "throw the big switch"?

I know I sound like an old-timer grumbling about the "good ol' days," but all of this is leading up to something I'd like you all to consider.

The problem of getting young people interested in amateur radio has been talked to death. The reasons why kids never get involved in this great hobby are numerous and have been stated and restated to the point of redundancy. To be sure, there are a few bright spots. People like Carole Perry WB2MGP are actually doing something about it. (Do you realize that she teaches amateur radio to 400 students every semester? *Four hundred!* Not all of those kids get or keep a license, but can you imagine what would happen if only one school in every state could follow her example?) The fact remains that unless we figure out a way to market and sell amateur radio to kids, many of us will live to see the end of this hobby. Unless we have the numbers that demand attention, and the youthful enthusiasm to fight for the disproportionate amount of spectrum we occupy, it won't be long before amateur radio is reduced to repeater wars on 2 meters and two old men calling CQ DX on 20 meters (both on the same frequency, no doubt).

It all boils down to this: We have got to find a way to put the magic back into amateur radio. We have got to figure out a way to show young people that they can have a blast with this hobby. Do you think your average twelve-year-old wants to spend his Saturday afternoons sitting behind a desk saying, "You're 5-9, I'll QSL through the bureau," or "You're number 125—good luck in the contest," or "Rig is . . . antenna is . . . QTH is . . . 73 and CUL." That's not magic! That's boring!

There are so many things about amateur radio that would fascinate a kid. Carole Perry has dozens of kids running around the halls of her school with little code practice oscillators that look like Star Trek communicators. These kids know a secret language—Morse code—and they think it's great. They know that radio is magic because they can hold the magic in their hands.

We published a letter a few months ago from a gentleman who was helping his grandchildren put together crystal radio sets. You give an eight-year-old a pile of parts, show her what to do, then watch her face as voices start coming out of something she has built herself. You won't have to explain to that eight-year-old about the magic of ham radio. She'll know it's magic. It's right there in front of her, and she did it herself.

Joe Fairclough WB2JKJ is the driving force behind the Junior High School 22 radio club in New York. He has taken a bunch of street kids from the toughest part of a very tough city and changed their lives. He is literally changing lives with nothing but amateur radio. You don't have to explain to his kids that radio is magic. They are living proof!

Do you remember what it was like, the first time you heard your very own callsign coming through the speaker? Did any of you feel you had the power of the universe right there at your fingers? Do you, oh patient reader, remember the magic?

Can we get the magic back . . . please? 73

Number 33 on your Feedback card

PROPAGATION

Jim Gray W1XU

Jim Gray W1XU
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Payson AZ 85541

A Few Good Days

Unfortunately, December is NOT predicted to be a particularly good month for DX on the high frequency bands. The "Good" days, indicated by "G" on the calendar, are expected to center around the 6th and the 16th; the "Poor" days, "P" on the calendar, center around the 10th and the 25th. All the other days of December trend from "Fair" (F) to "Poor" (P) or from "Poor" to "Fair."

Coupled with an unsettled-to-active magnetic field on the "Poor" days, you can expect early darkness in the Northern Hemisphere, with bands above 20 meters closing shortly before or after dark. The bands *below* 20 meters will likely be quite usable, even on the "Poor" days. You can expect DX across the equator, especially across the north pole into the USSR, during evening hours local time.

Winter solstice propagation on the higher HF bands of 20–10 meters is likely to be daytime only, with some short skip possibilities occurring on many days . . . but don't expect too much for 10 and 12 meters. Any DX you find will be a bonus. Some of the best DX opportunities may happen along the line of the terminator. The terminator is the path of advancing darkness in one half of the earth which corresponds to advancing dawn on the other half. Listen just before and after dark, and just before and after dawn.

I hope my gloomy forecast is wrong, and I'm looking forward to giving you a better one next month. Remember to monitor WWV at 18 minutes after any hour and look for LOW "A" index and HIGH solar flux reports for your best conditions. Trends are always helpful if you keep a log every day. The best of Season's Greetings to all of you. 73

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GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	15	20	–	20	20	–	20	20	–	10	–	15
ARGENTINA	7/10	10/15	10/15	10/15	–	–	–	–	10	10	10	15
AUSTRALIA	10/15	7/10	–	–	20	40	20	20	7/10	–	20	7/10
CANAL ZONE	15	20	20	80	–	40	–	10	10	10	10	10
ENGLAND	40	10/15	10/15	10/15	40	–	–	10/15	7/10	15	20	40
HAWAII	7/10	20	20	20	20	40	40	–	7/10	–	–	7/10
INDIA	–	20	20	–	–	–	20	15	–	–	–	–
JAPAN	15	20	–	20	20	–	20	20	–	10	–	15
MEXICO	15	20	20	80	–	40	–	10	10	10	10	10
PHILIPPINES	15	–	–	–	–	–	20	20	10/15	–	–	–
PUERTO RICO	15	20	20	80	–	40	–	10	10	10	10	10
SOUTH AFRICA	20	40	–	–	–	–	–	–	10	10	7/10	20
U.S.S.R.	–	–	–	–	–	–	–	7/10	10/15	7/10	–	–
WEST COAST	7/10	10/15	15	40	40	40	–	–	10/15	10	10	10

CENTRAL UNITED STATES TO:

ALASKA	10/15	7/10	–	–	20	–	–	20	–	–	–	–
ARGENTINA	20	20	20	20	20	–	–	–	–	10	7/10	7/10
AUSTRALIA	10	–	–	–	–	40	40	20	10/15	15	15	15
CANAL ZONE	20	20	10/15	10/15	40	40	–	7/10	7/10	10/15	10/15	15
ENGLAND	40	10/15	10/15	10/15	–	–	–	10/15	10/15	7/10	7/10	20
HAWAII	7/10	20	20	20	10/15	10/15	40	20	–	15	–	7/10
INDIA	20	15	20	–	–	–	20	20	–	–	–	–
JAPAN	7/10	7/10	–	–	20	–	–	20	–	–	–	–
MEXICO	20	20	10/15	10/15	40	40	–	7/10	7/10	7/10	7/10	15
PHILIPPINES	10	7/10	–	–	–	–	–	–	20	20	–	–
PUERTO RICO	20	20	10/15	10/15	40	40	–	7/10	7/10	7/10	7/10	15
SOUTH AFRICA	20	10/15	–	–	–	–	–	–	10	10/15	15	15
U.S.S.R.	–	40	40	20	20	–	–	15	10	20	–	–

WESTERN UNITED STATES TO:

ALASKA	*	*	–	–	–	–	40	40	–	–	20	10/15
ARGENTINA	10	15	20	10/15	10/15	20	–	–	–	15	10	10
AUSTRALIA	10	20	20	–	–	–	40	–	–	15	–	–
CANAL ZONE	20	10/15	10/15	10/15	10/15	40	–	–	10/15	10	10	15
ENGLAND	–	–	–	40	40	20	–	–	10/15	7/10	20	20
HAWAII	15	7/10	7/10	20	–	40	40	–	–	15	10	10
INDIA	–	10/15	20	–	–	–	–	–	20	–	–	–
JAPAN	**	**	–	–	–	–	40	40	–	–	20	7/10
MEXICO	20	10/15	10/15	10/15	10/15	40	–	–	10/15	10	10	15
PHILIPPINES	10	15	–	–	–	–	–	–	20	20	20	15
PUERTO RICO	20	10/15	10/15	10/15	10/15	40	–	–	10/15	10	10	15
SOUTH AFRICA	20	20	20	–	–	–	–	–	–	10	10/15	15
U.S.S.R.	–	–	–	40	20	20	–	–	15	20	–	–
EAST COAST	7/10	7/10	15	40	40	40	–	–	10/15	7/10	*	*

*Notes: The bands shown are likely to represent the highest frequency available to the desired areas at the time shown. Work from there to a lower frequency band when the higher frequency band is not open. (1) Rare, and only on a "good" day. Blank spaces (–) mean the path is not workable at that time. * 15/10/00; ** 10/15/00*

DECEMBER 1990

SUN	MON	TUE	WED	THU	FRI	SAT
						1 P
2 P–F	3 F	4 F	5 F–G	6 G	7 G	8 G–F
9 F–P	10 P	11 P–F	12 F	13 F	14 F	15 F–G
16 G	17 G	18 G–F	19 F–P	20 P	21 P	22 P–F
23 F–P	24 P	25 P	26 P	27 P–F	28 F	29 F
30 F–P	31 P					

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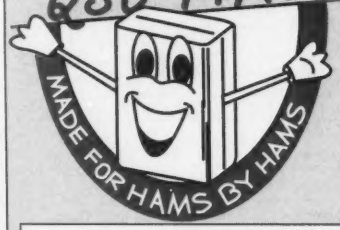

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H-Plane beamwidth	37 deg
Sidelobe attenuation	
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1st H-Plane	- 15 dB
SWR	1.13:1 typical
F/B ratio	22 dB
Impedance	50 ohm

MECHANICAL SPECIFICATIONS:

Length	17ft 4in
Boom	1.375" 6061 T-6 Aluminum
Elements	1/4" Aluminum rod
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Mast	up to 2" diameter
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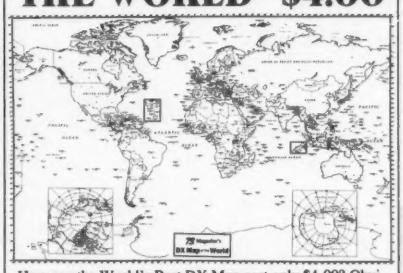

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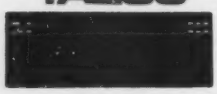

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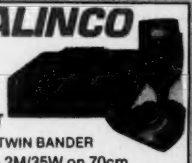

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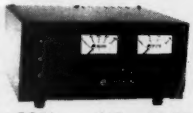

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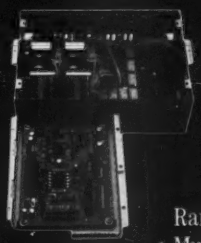

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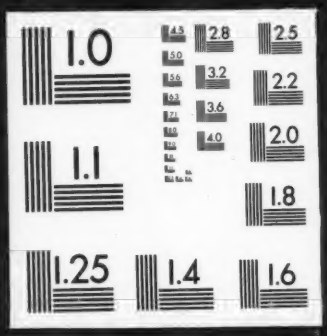
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